

RECOVERIES OF TAGGED BLUE KING CRABS *PARALITHODES PLATYPUS*
IN ST. MATTHEW ISLAND COMMERCIAL FISHERIES, 1995 – 1998



By

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ABSTRACT

Preseason pot surveys of blue king crabs *Paralithodes platypus* were conducted in 1995 and 1998 by the Alaska Department of Fish and Game (ADF&G) in the St. Matthew Island area, Alaska to augment spatial distribution and abundance data provided annually by the National Marine Fisheries Service (NMFS) eastern Bering Sea (EBS) trawl survey. During the 1995 preseason pot survey, 2,296 male and 437 female crabs were tagged and released from two tagging strata. Spatial trends in tag-recovery rate by location of preseason release and trends in displacement between preseason release and recovery during the commercial fishery are described and compared between the 1995 and 1998 tag releases. These trends show that the portion of exploited stock that is surveyed for abundance estimation by the NMFS EBS trawl survey can vary substantially among years. We estimated the harvest rate of legal male blue king crabs incurred in 1995 by examining the differential tagged crab recovery rates by tagging strata in the subsequent 1995 – 1998 fisheries using a modified band-recovery model. Our 1995 estimated harvest rate on legal males occupying the area surveyed by the 1995 pot survey was 36.8%.

Keywords: blue king crab; *Paralithodes platypus*; St. Matthew Island, Alaska; spatial distribution, abundance, harvest rate, pot survey, trawl survey, modified band-recovery model, tag-recovery rates

INTRODUCTION

The St. Matthew Island Section for blue king crabs *Paralithodes platypus* is within the Northern District of the Bering Sea king crab registration area (Area Q2) and includes the waters north of the latitude of Cape Newenham (58°39' N. lat.) and south of the latitude of Cape Romanzof (61°49' N. lat.; Bowers et al. 2003). Commercial fisheries for blue king crabs in the St. Matthew Island area occurred from the 1977 through the 1998 seasons, with a peak harvest of 9.5 million pounds landed in 1983. The St. Matthew Island blue king crab fishery was closed in 1999 however, and has remained closed through the 2003 season because stock levels have been below the threshold specified in the harvest strategy or have been too low to provide the minimum harvest level specified in regulation. The St. Matthew Island blue king crab fishery was declared overfished in 1999 due to an estimated stock size lower than the minimum stock size threshold specified in the Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs (NPFMC 1998).

Pot surveys with the primary objective of determining the distribution and relative abundance of male and female blue king crabs in the St. Matthew Island area have been conducted by the Alaska Department of Fish and Game (ADF&G) on a triennial basis since 1995 (Blau 1996, Blau and Watson 1999, Watson and Burt 2002). The pot surveys are intended to augment data on St. Matthew Island blue king crab spatial distribution and abundance that is supplied annually through summer trawl surveys performed by the National Marine Fisheries Service (NMFS; Rugolo et al. 2003). Data from the annual trawl surveys conducted by NMFS are used to estimate population abundance of St. Matthew Island blue king crabs and to determine harvest levels for the subsequent fall commercial fishery (Vining and Zheng 2003). However, the spacing between the tow locations during the trawl survey near St. Matthew Island (either 26 km or 37 km, depending on direction) as well as rocky bottom areas that preclude trawling, particularly nearshore, pose problems for adequately assessing population status of the stock. The spacing of sampling locations limits the trawl survey's ability to delineate the spatial distribution of blue king crabs in the St. Matthew area that are revealed by the pot survey (Vining et al. 2001). Additionally, the restrictions on trawlable areas limit the trawl survey's ability to sample areas that the pot survey shows have high densities of mature and legal blue king crabs. Hence, population estimates afforded by the trawl survey data are uncertain and the harvest rate incurred annually during the commercial fishery is difficult to ascertain without an independent means of assessment.

ADF&G instituted tagging programs concurrent with the 1995 and 1998 pot surveys and conducted tag-recovery programs in the subsequent commercial fisheries (Blau 1996, Blau and Watson 1999). One goal of the tagging program was to better estimate fishery harvest rates on legal males and to evaluate the effect of preseason spatial distribution of legal males on probability of capture during the subsequent fisheries. Here we report on results relative to that goal and also briefly report on tag recoveries of sublegal males and females. Other goals of the tagging program included gaining data to estimate productivity parameters (e.g., growth and natural mortality). Those results have been reported elsewhere (Siddeek et al. 2002) or will be reported in companion reports.

METHODS

Methods and results from the surveys are reported in detail in operational plans (Watson et al. 1995, Blau and Watson 1998) and survey reports (Blau 1996, Blau and Watson 1999). Relevant methods are provided here.

1995 Mark-Recapture Study

Survey Design

A grid pattern of 138 stations was selected for the survey area, which was divided into two strata of different sampling intensity (Figure 1). Stratum 2 was defined to include the area where commercial fishing efforts were concentrated during the 1990-1994 seasons, as indicated from data collected by onboard observers. Stations were more densely arrayed in Stratum 2 than in Stratum 1. In Stratum 1, stations (n=84) were spaced 5.0 nmi (9.3 km) apart north-to-south and east-to-west and 7.1 nmi (13.1 km) apart northwest-to-southeast and northeast-to-southwest. In Stratum 2, stations (n=54) were spaced 5.0 nmi (9.3 km) apart north-to-south and east-to-west and 3.5 nmi (6.5 km) apart northwest-to-southeast and northeast-to-southwest. At each station four king crab pots were set north-to-south and fished an average of 30-36 hours. The survey was conducted during 3-19 August 1995, with all tag-and-release occurring during 4-19 August 1995. Catch by station and other details on survey design and results can be found in Blau (1996).

Tagging Strategy

Two tag types were employed during the survey: **external** (yellow Floy or “spaghetti” tags laced through the isthmus muscle) and **internal** (passive integrated transponder or “PIT” tags injected into the left, fifth pereopod).

Legal Males. Only legal-sized males (i.e., those ≥ 139.7 -mm or 5.5-inches in carapace width) were tagged. Different tagging goals by station were established for Stratum 1 and Stratum 2. Survey plans originally called for tagging legal males only with Floy tags in Stratum 1 and to tag only up to 40 legal males per station in Stratum 1 (Blau 1996). However, all the legal males captured during the survey in Stratum 1 that were considered fit (i.e., no obvious injuries or diseases) for tagging were tagged and some were tagged with PIT tags. A total of 1,102 legal males were Floy-tagged and 35 legal males were PIT-tagged in Stratum 1.

By contrast, the tagging goal for Stratum 2 was set at up to 60 legal males per station using Floy tags and up to 60 legal males using PIT tags. The tagging strategy for Stratum 2 was followed with minor exceptions during the survey, resulting in 1,194 legal males tagged with Floy tags and 1,168 legal males tagged with PIT tags.

Analysis of PIT tag recoveries will be documented in a companion report.

Females. Original survey plans called for tagging up to 25 mature females ≥ 90 -mm carapace length (CL) with Floy tags only in Stratum 2 and those plans were followed with minor exceptions during the survey. Four-hundred-twenty-one (421) mature females were tagged with Floy tags in Stratum 2, only 13 of which were < 90 -mm CL. Additionally, one mature female > 90 -mm CL was Floy-tagged in Stratum 1 and 15 immature females ranging in size from 78-mm to 107-mm CL were Floy-tagged in Stratum 2.

Tagged-Crab Recovery

Recovery of tagged crabs during the 1995-1998 commercial fisheries was accomplished by dockside samplers and at-sea shellfish observers. The commercial fishery began each year on September 15 during 1995-1998, and remained open for as little as 5 days (1995) to as long as 11 days (1998; Bowers et al. 2003). Samplers were stationed in Dutch Harbor, Akutan, King Cove, Kodiak, and St. Paul to physically observe individual crab offloads for the presence of tagged crabs. Observers aboard fishing vessels and at-sea processors also monitored landings in a similar manner. All samplers and observers collected tagged crab recovery data from vessel crews as well as biological data on individual crabs. A tag reward program was instituted using custom baseball caps as incentives for the return of tagged crab information.

1998 Mark-Recapture Study

Survey Design

A grid pattern of 137 stations including areas north and east of St. Matthew Island was selected for the 1998 survey area based on the grid established for the 1995 survey (Figure 2). However, unlike the 1995 survey, there was no increased station density inside the area established as Stratum 2; all stations were spaced 5.0 nmi (9.25 km) apart north-to-south and east-to-west and 7.1 nmi (13.1 km) apart northwest-to-southeast and northeast-to-southwest regardless of survey stratum. The surveyed area was expanded relative to the 1995 survey with the addition of 35 stations to the north (stations 156-200; Figure 2). Additionally, station 23 was fished for the first time during the 1998 survey as it was dropped during the 1995 survey due to weather. For data analysis in this report, all 104 stations outside of the 1995 Stratum 2 boundary, including the 35 stations north of the 1995 survey area and station 23 were placed in Stratum 1; the 33 stations falling within the 1995 Stratum 2 boundary were placed in Stratum 2. With the exception of one three-pot station, each station consisted of four king crab pots set north-to-south with an average soak time of 30-36 hours. The survey was conducted during 2-24 August 1998, with all tag-and-release occurring during 4-21 August 1998. Catch by station and other details on survey design and results are in Blau and Watson (1999).

Tagging Strategy

External fluorescent pink Floy “spaghetti” tags were used exclusively in the study and affixed to crabs as described above. The tagging goal at each station was 60 legal and 60 sublegal (≥ 90 mm CL) male blue king crabs. For legal males, 2,527 were tagged in Stratum 1 and 1,122 were

tagged in Stratum 2. For sublegal males, 1,500 were tagged in Stratum 1 and 501 were tagged in Stratum 2.

Tagged-Crab Recovery

Dockside samplers and at-sea shellfish observers recovered tagged crabs during the 1998 commercial fishery using methodology similar to that used in 1995. The 1998 commercial fishery opened on September 15 and closed on September 26 (Bowers et al. 2003).

Estimation of Harvest Rate by Tagging Stratum during the 1995 Commercial Fishery

Differential tag recovery rates by tagging stratum during the 1995 through 1998 commercial fisheries provide a method for estimating the harvest rate of legal male blue king crabs by tagging stratum by modification of band-recovery models (Brownie et al. 1985),

where

N_i = number of legal males tagged and released in Stratum i prior to the 1995 commercial fishing season,

$R_{i,95}$ = number of recoveries during the 1995 commercial fishing seasons of legal males tagged and released in Stratum i prior to the 1995 commercial fishing season,

$R_{i,96-98}$ = number of recoveries during the 1996-1998 commercial fishing seasons of legal males tagged and released in Stratum i prior to the 1995 commercial fishing season, and

$H_{i,95}$ = harvest rate during the 1995 commercial fishing seasons of legal males occupying Stratum i prior to the 1995 commercial fishing season.

For legal males tagged prior to the 1995 commercial fishery season, we assume that the probability of tag recovery during a subsequent commercial fishery season is proportional to the probability of a legal male being captured (i.e., harvested) during that commercial fishery season. We assume that the ratio of tag recovery probability to harvest probability is less than or equal to one (1) and is independent of the location of a legal crab at the time of tagging. That is, we assume that the factors that can result in tag-recovery rates being lower than harvest rates (e.g., non-detection of recovered tags, tag loss, or any sub-lethal and lethal effects to tagged crabs that can reduce probability of capture during a commercial fishery) are unrelated to the tag release site. We do not assume that probability of harvest during the 1995 commercial fishery season is independent of preseason spatial distribution; our model allows for different probabilities of harvest during the 1995 commercial season between legal males occupying Stratum 1 prior to the 1995 season and those occupying Stratum 2 prior to the 1995 season. However, we do assume that all legal males that survived the 1995 commercial fishery season had an equal probability of being harvested during the 1996-1998 commercial seasons, independent of their distribution prior to the 1995 commercial season.

Under those assumptions, the probability of harvest during the 1995 commercial season by strata, $H_{1,95}$ and $H_{2,95}$, can be estimated by the functions

$$h_{1,95} = B_{12,95}(1-B_{21,96-98})/(1-B_{12,95}B_{21,96-98}),$$

and

$$h_{2,95} = (1-B_{21,96-98})/(1-B_{12,95}B_{21,96-98}),$$

where

$$B_{12,95} = (r_{1,95}/N_1)(N_2/r_{2,95}),$$

$$B_{21,96-98} = (r_{2,96-98}/N_2)(N_1/r_{1,96-98}),$$

and $r_{1,95}$, $r_{2,95}$, $r_{2,96-98}$, and $r_{1,96-98}$ are, respectively, the observed values of $R_{1,95}$, $R_{2,95}$, $R_{2,96-98}$, and $R_{1,96-98}$.

The sampling distributions of $h_{1,95}$ and $h_{2,95}$ were estimated via parametric bootstrapping (Efron and Tibshirani 1993). One thousand replicate outcomes were generated as follows:

$$p_{1,95} = r_{1,95}/N_1,$$

$$p_{1,96-98} = r_{1,96-98}/N_1,$$

$$p_{2,95} = r_{2,95}/N_2,$$

$$p_{2,96-98} = r_{2,96-98}/N_2.$$

k_i = the number of survey stations in Stratum i at which legal males were tagged and released prior to the 1995 commercial fishery season, and

$n_{i,j}$ = the number of legal males tagged and released prior to the 1995 commercial fishery season at the j th survey station in Stratum i .

For each of the 1,000 replicates, the following observations were generated using the *rbinom* function of S-Plus (MathSoft, Inc. 1999):

$c_{95,1,j}$, generated as a random observation from a binomial distribution with parameters $n_{1,j}$ and $p_{1,95}$ for each $j = 1$ to k_1 ,

$c_{96-98,1,j}$, generated as a random observation from a binomial distribution with parameters $(n_{1,j} - c_{95,1,j})$ and $(p_{1,96-98}/(1 - p_{1,95}))$ for each $j = 1$ to k_1 ,

$c_{95,2,j}$, generated as a random observation from a binomial distribution with parameters $n_{2,j}$ and $p_{2,95}$ for each $j = 1$ to k_2 ,

$c_{96-98,2,j}$, generated as a random observation from a binomial distribution with parameters $(n_{2,j} - c_{95,2,j})$ and $(p_{1,96-98}/(1 - p_{1,95}))$ for each $j = 1$ to k_1 ,

$r_{1,95}$, the sum of the $c_{95,1,j}$'s for $j = 1$ to k_1 ,

$r_{1,96-98}$, the sum of the $c_{96-98,1,j}$'s for $j = 1$ to k_1 ,

$r_{2,95}$, the sum of the $c_{95,2,j}$'s for $j = 1$ to k_2 , and

$r_{2,96-98}$, the sum of the $c_{96-98,2,j}$'s for $j = 1$ to k_2 .

Then, values of $h_{1,95}$ and $h_{2,95}$ were computed using the generated observations, $r_{1,95}$, $r_{1,96-98}$, $r_{2,95}$, and $r_{2,96-98}$, and N_1 and N_2 for each of the 1,000 replicates.

An estimate of the 1995 harvest rate on legal males occupying the entire survey area prior to the 1995 commercial fishery season, $H_{,95}$, can be estimated as a weighted average of the two estimates, $h_{1,95}$ and $h_{2,95}$, using the form

$$h_{,95} = (h_{1,95}A_1D_1 + h_{2,95} A_2D_2) / (A_1D_1 + A_2D_2),$$

where

A_i is the area surveyed in 1995 within Stratum i , and

D_i is an index of the density of legal males within Stratum i during the 1995 survey.

During the 1995 survey, Stratum 1 surveyed an area of approximately 2,100 nmi², yielding a density of legal males, as indexed by catch per pot lift (CPUE) of 3.46, whereas Stratum 2 surveyed approximately 800 nmi² and yielded a legal male CPUE of 12.47 (Blau 1996).

RESULTS

1995 Mark-Recapture Study

Recovery Rates and Effects of Release Site

Legal Males. Legal male blue king crabs were recovered in 1995 at a rate of 9.5%; recovery rates declined to 7.6% in 1996, 4.3% in 1997, and 1.3 % in 1998 (Table 1). Recovery in the combined 1995-1998 fisheries was 22.6%. For the combined 1995-1998 commercial fisheries, the tag-recovery rates for those legal males tagged and released in Stratum 1 was only slightly lower than for those tagged and released in Stratum 2 (Table 1, Figure 3). However, tag-recovery rates differed markedly by stratum of release during each of the 1995 and 1996 commercial fisheries (Figures 4 and 5). During the 1995 fishery, legal males tagged and released in Stratum 2 were recovered at over 8 times the rate of those tagged and released in Stratum 1 and accounted for 90% of the 217 total recovered tags (Table 1). In contrast, during the 1996 fishery legal males tagged and released in Stratum 1 were recovered at over 3 times the rate of those tagged and released in Stratum 2 and accounted for 75% of the 175 total recovered tags (Table 1). During the 1997 commercial fishery, the recovery rate for those tagged and released from Stratum 1 was only marginally greater than that of those released in Stratum 2 (Table 1, Figure 6). However, for the combined 1996-1998 commercial fisheries those tagged and released from Stratum 1 were recovered at a rate 3 times that of those released in Stratum 2 (Table 1, Figures 6 and 7).

The dependency of recovery rate by fishery on release site was also evident at a more localized scale than tagging stratum. During the 1995 fishery those legal males tagged and released north of 60°05' N. latitude and east of 173°15' W. longitude showed the highest recovery rates, whereas those tagged south of 60°00' N. latitude and west of 173°10' W longitude showed low

recovery rates (Figure 8). During the 1996-1998 fisheries however, it was legal males tagged south of 60°00' N. latitude and west of 173°10' W. longitude that were recovered at the highest rates.

Trends in recovery rate by latitude and longitude of release are related to depth of release site. During the 1995 fishery, tag recovery rates were low for legal males tagged and released at depths greater than 75 m, whereas legal males tagged and released at depths greater than 75 m had the highest recovery rates during the 1996-1998 fisheries (Figure 9). Highest recovery rates during the 1995 fishery were obtained from those legal males tagged and released at depths shallower than 55 m; 172 of the 877 (19.6%) legal males tagged and released at depths < 55 m were recovered during the 1995 fishery. By contrast, of 946 legal males released at depths > 75 m, only 5 (0.5%) were recovered during the 1995 fishery. However, 191 (21.1%) of those released at depths > 75 m were eventually recovered during the 1996-1998 fisheries.

Survey catch, numbers tagged, and recovery of legal males by station and stratum is detailed in Appendix A.1.

Females. Only 20 of the 422 tagged mature females (4.74%) were recovered from the 1995-1998 commercial fisheries: 17 during the 1995 fishery, 1 from the 1996 fishery, and 2 from the 1998 fishery. One of the 15 tagged immature females (6.7%) was recovered during the 1995 fishery. There were no recoveries of immature females during the 1996-1998 commercial fisheries.

Survey catch, numbers tagged, and recovery of mature females by station and stratum is detailed in Appendix A.2. Survey catch, numbers tagged, and recovery of immature females by station and stratum is detailed in Appendix A.3.

Recovery Locale of Legal Males and Displacement from Release Site to Recovery Site

1995 Fishery. Of the 217 tagged legal males recovered during the 1995 commercial fishery, recovery location was recorded from 114, recovery depth was recorded from 123, and both recovery location and depth were recorded from 104. Legal males tagged in Stratum 2 accounted for 89% of the recoveries with location and depth recorded, comparable to the 90% contribution of legal males tagged in Stratum 2 to the total recoveries of legal males during the 1995 fishery. Recovery locations were concentrated in an arc within Stratum 2 centered at 60°10' N. latitude, 172°54' W. longitude and roughly paralleling the southwest coast of St. Matthew Island (Figure 4). Depths recorded for recaptures fell largely in the range of 51-65 m (Figure 10) and the average of the recorded depths at capture was 59 m.

Average linear distance from tag-release site to tag-recovery site in 1995 was 20 km (Table 2); minimum displacement recorded was 3 km and maximum displacement recorded was 85 km. On average, those recovered legal males with recapture site data recorded were 10 km south and 1 km west of release site and in waters 7 m deeper than the release site (Table 2). However, just as tag-recovery rate was dependent on release stratum, displacement from release site to recovery site was strongly dependent upon the survey stratum of release. The linear distance of displacement for those released from Stratum 1 averaged nearly double that for those released

from Stratum 2. The average trajectory of displacement for those released from Stratum 1 (4 km to the north and 12 km to the east) had a strong easterly component and was close to being the exact opposite to that for those released from Stratum 2 (12 km to the south and 3 km to the west). Those released from Stratum 1 were recaptured in waters averaging 7 m shallower than their release site; those released from Stratum 2 were recaptured in waters averaging 9 m deeper than their release site. Those differences among release strata reflect trends associated with release site at a more localized scale. Linear displacement to the north was negatively correlated with N. latitude of release site ($r = -0.742$, chi-square = 88.375, d.f. = 1, $P < 0.001$), linear displacement to the west was negatively correlated with W. longitude of release site ($r = -0.756$, chi-square = 93.746, d.f. = 1, $P < 0.001$), and depth displacement was negatively correlated with depth of release site ($r = -0.917$, chi-square = 219.222, d.f. = 1, $P < 0.001$).

1996-1998 Fisheries. A total of 132 legal males tagged in 1995 were recaptured during the 1996-1998 commercial St. Matthew Island fisheries with recovery location recorded: 86 from the 1996 fishery, 36 from the 1997 fishery, and 10 from the 1998 fishery. The distribution of recovery locations was similar among the 1996-1998 fisheries (Figures 5, 6, and 7); mean recovery location during the combined 1996-1998 fisheries was 60°07' N. latitude, 173°03' W. longitude. Although most recoveries occurred within survey Stratum 2, locations tended to be south and west of those for the 1995 fishery (Figure 4). Depth was recorded from 161 recoveries during the 1996-1998 fisheries; 76 in 1996, 70 in 1997 and 15 in 1998. Distribution of depths recorded for recoveries from the 1996 through 1998 fisheries were similar across seasons, but tended to be deeper than those recorded from the 1995 fishery (Figure 10). Average recorded depth at recovery from the 1996-1998 fisheries was 66 m.

1998 Mark-Recapture Study

Recovery Rates and Effects of Release Site

Legal Males. Legal male blue king crabs were recovered in 1998 at an overall rate of 15.4% (Table 3). Tag recovery rate was dependent upon stratum of release; the recovery rate for legal males tagged in Stratum 2 was 2.7 times higher than for those tagged in Stratum 1. Within Stratum 1, recovery rates from releases within the area surveyed in 1995 were comparable overall to those for releases from the stations added to the north for the 1998 survey (i.e., stations 156-200). Of the 2,086 legal males released from Stratum 1 stations within the 1995 survey area, 212 (10.2%) were recovered during the 1998 fishery; of the 441 legal males released from newly-added stations in the northern portion within Stratum 1, 43 (9.8%) were recovered.

Dependence of recovery rate on release site was also evident at a scale more localized than survey stratum (Figure 11). Of the 111 legal males tagged and released at 11 of the 20 stations north of St. Matthew Island and east of 173°00' W. longitude, only one (0.9%) was recovered during the 1998 fishery. Although there were recoveries from tags released at all latitudes and longitudes surveyed, trends related to latitude and longitude were evident. Tag recovery rates were generally greater than 10% for those tagged at latitudes of 59°42' to 60°43' N. latitude and were 20% or greater for those tagged at latitudes of 60°02' to 60°13' N. latitude (Figure 12). Tag recoveries by longitude of release were highest (in excess of 15%) for those legal males tagged

and released at longitudes of 172°25' to 173°25' W. longitude. Recovery rates were notably dependent on the depth of the tagging and release site. Legal males representing all depth-zones of tag release were recovered during the 1998 fishery, but probability of recovery showed a strong negative association with depth of release site (Figure 13).

Survey catch, numbers tagged, and recovery of legal males by station and stratum is detailed in Appendix B.1.

Sublegal Males. Tagged sublegal males were recovered at a rate of 6.6% during the 1998 commercial fishery, with those released from Stratum 2 recovered at almost double the rate of those released in Stratum 1 (Table 3). Recoveries were obtained from a broad range of release sites and were similar in distribution to those of recovered legal males (e.g., Figure 11). Although there were some recoveries of sublegal males released from stations northwest of St. Matthew Island, highest recovery rates tended to occur for those released from stations south of 60°25' N. latitude and west of 172°45' W. longitude. Within that southwesterly area, 109 of 1,324 (8.2%) sublegal male crabs were recovered. By contrast, sublegals released northeast of St. Matthew Island showed the lowest recovery rates; of 344 crabs released, only 6 (1.7%) were recovered. Fourteen of the males recorded as sublegals at release were recorded as legal-sized crabs at recapture during the fishery, although none of the data recorded from those crabs showed an increase in size and change in shell age consistent with molting between the survey and the fishery. Those 14 crabs were on the border of legal size, ranging in size from 112-mm to 128-mm CL at release. Rather than molting to legal size between the survey and the fishery, the disparity in legal status at time of release and recovery for those 14 crabs likely represents error in assignment to legal status at release or recovery.

Survey catch, numbers tagged, and recovery of sublegal males by station and stratum is detailed in Appendix B.2.

Recovery Locale and Displacement from Release Site to Recovery Site

Legal Males. Latitude and longitude of recapture site was recorded by vessel captains for 432 tagged legal males. Legal males tagged and released in Stratum 2 accounted for 54.4% of the recoveries with location recorded, comparable to the 54.6% contribution of legal males tagged in Stratum 2 to the total recoveries of legal males tagged in 1998 during the 1998 fishery. Most recoveries occurred in a broad arc roughly 30-55 km south and west of St. Matthew Island centered at a mean latitude of 60°09' N. latitude and a mean longitude of 173°16' W. longitude (Figure 11). Recorded recovery locations were concentrated by latitude between 60°00' and 60°15' N. latitude (68% of recovery locations); longitude of recoveries was concentrated between 173°00' to 173°45' W. longitude (81% of recovery locations). Forty-four percent of the recorded recovery locations were within survey Stratum 1. Depths of recovery sites were recorded for 448 tagged legal males, 53.6% of which were from legal males tagged and released in Stratum 2; location, as well as depth, was recorded for 416 recoveries. Recorded depths for recoveries ranged from 55 m to 90 m and averaged 69 m.

For those recoveries with location recorded, average linear distance from release site to recovery site was 21 km (Table 4; median = 18 km) and 95% of the recorded recovery sites were within

55 km of the release site. Distance from release site to recovery site averaged slightly greater for those released from Stratum 1 (24 km) than those released from Stratum 2 (20 km). On average, there was little displacement in latitude from release site to recovery site (1 km to the south) and only a slight displacement in longitude (4 km to the west). On the other hand, trends in displacement from release site to recovery site in latitude and longitude were more evident when recoveries were grouped by stratum of release (Table 4). Those released in Stratum 1 tended to be recovered to the north and east of release site, whereas those released in Stratum 2 tended to be recovered to the south and west of release site. The probability of recapture south and west of release site for those released in Stratum 2 was greater than the probability of recapture north and east of release site for those released in Stratum 1, however. Of those released in Stratum 1, 65% (128 of 197) were recovered north of release site and 61% (120 of 197) were recovered east of release site. Of those released in Stratum 2, 83% (195 of 235) were recovered south of release site and 80% (187 of 235) were recovered west of release site. Distance north from release site to recovery site was negatively correlated with latitude of release ($r = -0.585$, chi-square = 180.212, d.f. = 1, $P < 0.001$). That relationship was close to linear for release sites south of $60^{\circ}15'$ N. latitude (Figure 14). Distance west from release site to recovery site was negatively correlated with longitude of release ($r = -0.581$, chi-square = 176.633, d.f. = 1, $P < 0.001$). That relationship was strongest for release sites west of $173^{\circ}00'$ W. longitude (Figure 14).

Shifts in depths were related to shifts in location from release to recovery. Those released from Stratum 1 tended to be recovered from shallower waters than the release site (153 of 208, 74%), whereas those released in Stratum 2 tending to be recovered in deeper waters than the release site (194 of 240, 81%). For all recovered legal males with depth at recovery recorded, the average change in depth was 1 m deeper. However, those released from Stratum 1 were recovered at depths averaging 7 m shallower than release site, whereas those released from Stratum 2 were recovered at depths averaging 8 m deeper than release site. Change in depth from release site to recovery site showed a strong negative relationship ($r = -0.887$, chi-square = 686.467, d.f. = 1, $P < 0.001$) that was close to linear over the depth range of tag-release sites (Figure 14).

Sublegal Males. Of the 132 recovered sublegal males, recovery locale was recorded for 123, recovery depth was recorded for 125, and depth and locale of recovery was recorded for 121. Crabs released from Stratum 1 accounted for 75 of the recoveries with recovery locale data and 75 of the recoveries with recovery depth data. The recorded recovery locations of sublegal males was similar to that of legal males in 1998, but more tightly concentrated in the southwest portion of the arced pattern of fishing distribution (Figure 11). Recorded depths for recoveries ranged from 55 m to 90 m and averaged 72 m.

The average distance between release and recovery site for sublegal males was 17 km. There was little overall trend in displacement between release and recovery by latitude, longitude, or depth: average displacement by depth was 1 m shallower, average displacement by latitude was 1 km to the north, and average displacement by longitude was 1 km to the west. When recoveries are grouped by stratum of release, however, trends in displacement are evident. Sublegal males released from Stratum 1 were recovered an average 4 m shallower than release site, 4 km north of release site, and 2 km east of release site. Those released in Stratum 2 were recovered 4 m deeper than release site, 4 km south of release site, and 7 km west of release site. Average

distance from release to recovery site was comparable between those released from the two strata: 18 km for those released from Stratum 1 and 16 km for those released from Stratum 2.

Similar to the recovery pattern of legal males, sublegal change in depth from release site to recovery site showed a strong negative relationship ($r = -0.775$, chi-square = 112.252, d.f. = 1, $P < 0.001$) that was close to linear over the depth range of tag release sites. Distance north from release site to recovery site was negatively correlated with latitude of release ($r = -0.510$, chi-square = 35.726, d.f. = 1, $P < 0.001$). Similar to legal males, that relationship was close to linear for release sites south of 60°15' N. latitude. Distance west from release site to recovery site was negatively correlated with longitude of release ($r = -0.445$, chi-square = 26.130, d.f. = 1, $P < 0.001$). That relationship was strongest for release sites west of 173°00' W. longitude.

Estimation of Harvest Rate by Tagging Stratum during the 1995 Commercial Fishery

Applying the values from Table 1 ($N_1 = 1,102$, $r_{1,95} = 21$, $r_{1,96-98} = 204$, $N_2 = 1,194$, $r_{2,95} = 196$, and $r_{2,96-98} = 98$) results in harvest rate estimates of $h_{1,95} = 6.8\%$ and $h_{2,95} = 58.7\%$ for the 1995 commercial fishery on legal males occupying Stratum 1 and Stratum 2, respectively, prior to the fishery. Ninety-five percent confidence intervals (based on the 2.5th and 97.5th percentiles of the parametric-bootstrapped sampling distributions) are 3.4% to 10.0% for $H_{1,95}$ and 43.6% to 66.9% for $H_{2,95}$. The two estimates are positively correlated, with the linear correlation estimated from the parametric-bootstrapped bivariate sampling distribution at $r = 0.52$. The 1995 harvest rate on legal males occupying the area surveyed by the 1995 pot survey, estimated as a weighted average of the two estimates is $h_{,95} = 36.8\%$ with the 95% confidence interval of 27.2% to 42.5%.

DISCUSSION

The fall 1995-1998 St. Matthew Island commercial fisheries were managed under a harvest strategy that computed the guideline harvest level (GHL) by applying a 20% exploitation rate to the estimated abundance of “mature-sized males” (i.e., males ≥ 105 -mm CL), with the restriction that the harvest could not exceed 60% of the estimated abundance of legal-sized (equivalent to ≥ 120 -mm CL) males (Pengilly and Schmidt 1995). Abundance estimates to which the harvest strategy was applied were computed from the results of the annual NMFS eastern Bering Sea (EBS) summer trawl survey. The NMFS EBS trawl survey continues to be the primary data source for estimating abundance and condition of the St. Matthew Island blue king crab stock (Vining and Zheng 2003, Rugolo et al. 2003). However, the limited spatial distribution of the St. Matthew blue king crab stock and the presence of rocky bottom habitat within that distribution pose problems in using the NMFS EBS trawl survey data to assess the stock. As a result, there is large uncertainty in determining the status of the stock, in determining GHLs prior to the commercial fishery, and in evaluating the fishing effects on the stock after the fishery season is completed. Although the NMFS survey provides valuable information for evaluation of large-scale trends in stock status, it may be insufficient to adequately provide information needed for annual management decisions.

The standard NMFS survey is designed to cover a broad area of the eastern Bering Sea, requiring that stations generally be spaced 20 nmi (37 km) apart (Rugolo et al. 2003). Although the NMFS trawl survey station density is increased in the vicinity of St. Matthew Island to better sample the blue king crab stock, important nearshore areas are not adequately sampled to detect important spatial trends in stock distribution (Vining et al. 2001). The limited sampling of the NMFS trawl survey within the ADF&G pot survey area is noteworthy when considering the basis for the determination of the ADF&G pot survey area. The standard NMFS trawl survey design provides for 14 tows within the area covered by the 1995 ADF&G pot survey, 19 tows within the area covered by the 1998 ADF&G pot survey, and five tows within the area covered by Stratum 2 in the ADF&G pot survey. The survey area for the 1995 ADF&G pot survey encompasses 97% of the 492 fishing locations recorded by at-sea fishery observers during the 1990-1994 commercial fisheries (Watson et al. 1995). The ADF&G pot survey's Stratum 2 was designed to encompass 90% of fishing locations recorded by at-sea fishery observers during the 1990-1994 commercial fisheries. Hence, only a small portion of the NMFS trawl survey effort is expended within the area that the commercial fishery occurs. Additionally, the 1995 ADF&G pot survey revealed that the highest densities of legal-sized males and mature females during August (the month prior to the fishery and the month after sampling by the NMFS trawl survey) occurred nearshore relative to both the NMFS trawl survey distribution and the effort distribution in the commercial fishery (Blau 1996). The data on tag returns reported here provides further evidence that the standard NMFS trawl survey alone does not provide reliable stock-assessment information needed for annual fishery management decisions.

Recoveries of legal males tagged and released in 1995 showed that males occupying Stratum 2 one month before the 1995 commercial fishery were 8 times more likely to be harvested during the 1995 fishery than legal males occupying Stratum 1. Probability of harvest was greatest for crabs in shallow nearshore waters within Stratum 2 one month prior to the fishery. Crabs tagged in waters <55 m in depth within Stratum 2 during August 1995 were recovered during the 1995 fishery at a rate more than 20 times greater than crabs tagged in waters >75 m in depth throughout the survey area. Notably, the NMFS survey, which generally samples the St. Matthew Island area in July, rarely performs tows in waters less than 60 m in depth southwest of St. Matthew Island. Tag returns from the 1996-1998 fisheries indicate that legal males occupying Stratum 1 prior to the 1995 fishery were more likely to be harvested than those occupying Stratum 2 prior to the 1995 fishery. Given the spatial distribution of trawl survey sampling effort, the 1995 NMFS survey was more likely to sample from areas occupied by legal males that would contribute to the 1996-1998 fisheries than from areas occupied by legal males that would contribute to the 1995 fishery.

Seasonal movements of a crab stock are difficult to determine from tag returns when recoveries are obtained only from commercial fisheries. Not only is the period of recovery limited, but, more importantly, the area from which recoveries occur is limited to the area that commercial fishing occurs; i.e., there is no data for crabs that moved to areas where commercial fishing did not occur. Hence, the data characterize the movements of only crabs that have moved to a limited area and results cannot be generalized to the stock as a whole. Nonetheless, we suggest that there is a general southwestward movement of large male blue king crabs that occurs in late summer to early fall from an area of high density, perhaps mating aggregations, in the nearshore waters southwest of St. Matthew Island to deeper offshore waters. Such a seasonal movement is not

only suggested by the data on recovery site during the September 1995 fishery relative to tagging location for the legal males tagged during August 1995, but can be inferred by the trend in dependency of recovery probability on tag release site in 1995. Additionally, the distribution of mature male and female blue king crabs during the August 1995 pot survey (Blau 1996), the nearshore distribution of ovigerous female blue king crabs (Blau 1996, Blau 2000), and the distribution of commercial fishery effort all indicate that this seasonal movement occurs. Taken together, those patterns suggest that annual commercial fisheries capitalize on the movement of large males from shallow nearshore waters to deeper offshore waters. If such a seasonal movement does in fact occur, it would further diminish the ability of the standard NMFS EBS trawl survey to adequately assess the abundance of legal male blue king crabs in the St. Matthew Island area. Large males may be even more concentrated in shallower nearshore waters southwest of St. Matthew Island in July, when the NMFS survey typically visits the St. Matthew area, than in either August or September. More importantly, variations in timing of seasonal movement or in timing of trawl survey sampling could add noise to the time series of abundance indices based on the trawl survey data.

Whether or not such seasonal movements occur, there was clearly a difference in the spatial distribution of blue king crabs in the St. Matthew Island area that was not evident in the NMFS trawl survey data: mature animals, including legal males, were more widely dispersed in 1998 than in 1995 (Vining et al. 2000). This may have been due to warmer bottom temperatures in 1998 than in 1995. Bottom temperatures recorded from 13 tows in the St. Matthew Island vicinity during the 1995 NMFS EBS trawl survey ranged from -1.5° to 0.8° C and averaged -0.9° C, whereas bottom temperatures recorded from 14 tows in the St. Matthew Island vicinity during the 1998 NMFS EBS trawl survey ranged from 0.5° to 5.1° C and averaged 1.8° C. Data on fishing locations gathered by at-sea fishery observers indicate that the change to a more widely dispersed distribution for legal males may have occurred between 1995 and 1996. Of the 539 locations recorded by observers during the 1990-1995 fisheries, 91% were within the area identified as Stratum 2 for the ADF&G pot survey. During the 1996-1998 fisheries, only 57% of the 364 fishing locations recorded by at-sea observers were within Stratum 2.

Regardless of the reason for the difference in spatial distribution of legal male blue king crabs between 1995 and 1998, it appears that a larger portion of the legal male crab population was within the area surveyed by the NMFS trawl survey in 1998 than in 1995. That difference alone may account for a higher estimate of legal male abundance in 1998 (2.996 million animals) than in 1995 (2.496 million animals; Vining and Zheng 2003). The change in distribution also apparently affected trends in tag recoveries. Although legal males that occupied the shallower nearshore waters of Stratum 2 during August 1998 were more likely to be recovered during the September 1998 commercial fishery than those occupying Stratum 1, the susceptibility to harvest was spread widely over the pre-season distribution. Recovery locations were more widely dispersed in 1998 than in 1995 and there was less of a trend in displacement from release site to recovery site in 1998 to 1995. Also coincident with the change in spatial distribution from 1995 to 1998 were changes in fishery performance. During the 1995 fishery, 666,905 crabs were harvested in 5 days with an average catch of 14 crabs per pot; 612,346 crabs were harvested in 11 days during the 1998 fishery with an average catch of 7 crabs per pot (Bowers et al. 2003).

The 1995 pot survey area was designed to encompass the principal areas of commercial fishing and we developed a model to estimate the harvest rate in the 1995 fishery on legal males occupying that area in the month prior to the fishery. Our estimate was based on differential tag recovery rates for legal males tagged in the two survey strata. A fundamental assumption for our estimation model is that all tagged crabs surviving the 1995 fishery have an equal probability of recovery during the 1996-1998 fisheries, regardless of strata of release. Essentially, our model assumes that tagged crabs surviving the 1995 fishery were spatially redistributed prior to the 1996 fishery by a process that was independent of their location in 1995. If that were not the case, our fundamental assumption would not hold due to the systematic spatial distribution of fishery effort. Unfortunately, we were not able to test that fundamental assumption with the data available.

Our estimate for the harvest rate during the 1995 fishery on legal males occupying the pot survey area in August 1995 was 37% with a 95% confidence interval of 27% to 43%. That is higher than the 27% rate that would be obtained by dividing the number of crabs harvested in 1995 (666,905) by the estimated abundance of legal male blue king crab throughout all of Area Q at the time of the 1995 NMFS trawl survey (2.496 million crabs). Our tag-recovery data do not allow for estimating the harvest rate relative to all legal males occupying all of Area Q. We would expect that rate to be lower than the harvest rate we estimated for only those males occupying the 1995-survey area because the survey area is where most of the commercial harvest occurred. What may be most notable is the 1995 harvest rate of 59% estimated for legal males occupying Stratum 2 prior to the fishery. The reliability of that estimate may be questioned given the 16.4% tag recovery rate during the 1995 fishery for legal males tagged in Stratum 2. However, the disparity between estimated harvest rate and recovery may be attributable to tag loss or to lethal or sublethal effects of capture, tagging, and release prior to the 1995. Additionally, people performing tag recoveries at processing plants reported that the yellow-colored tags used in 1995 were extremely difficult to detect on blue king crabs. Regardless, it is difficult to explain the trends in recovery rates from the 1995 through 1998 fisheries for those legal males tagged in Stratum 2 versus those tagged in Stratum 1 without the harvest rate in 1995 being substantially higher than the tag-recovery rate in 1995.

Although it is tempting to directly compare the recovery rates from the 1995 tag release to those from the 1998 tag release, such comparisons are not warranted. The conditions for recovery of tags can vary from season to season. More importantly, the tags used in 1998 were a fluorescent pink color chosen specifically for greater detectability than the yellow tags used in 1995. The number of recoveries recorded at sea with location or depth data indicates the higher detectability of the tags released in 1998. Of the 562 legal males tagged in 1998 that were recovered during the 1998 fishery, 83% were recorded at sea with location or depth data; of the 28 recoveries during the 1998 fishery of legal males tagged in 1995, only 36% were recorded at sea with location or depth data. Nonetheless, the overall rate of recovery during the 1998 fishery of legal males tagged in 1998 (15.4%) is high enough to suggest that actual harvest rate during the 1998 fishery was higher than the 21% obtained by dividing the harvest of 612,346 crabs (Bowers et al. 2003) by the 2.966 million preseason estimate of legal male abundance (Vining and Zheng 2003).

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Table 1. Legal male blue king crab tagging effort during the 1995 Alaska Department of Fish and Game St. Matthew Island blue king crab pot survey and 1995-1998 commercial fishery recoveries.

Stratum	Survey Catch	Number Tagged	Commercial Fishery Recoveries									
			1995		1996		1997		1998		1995-1998	
			No.	%	No.	%	No.	%	No.	%	No.	%
1	1,172	1,102	21	1.91	131	11.89	49	4.45	24	2.18	225	20.42
2	2,679	1,194	196	16.42	44	3.69	50	4.19	4	0.34	294	24.62
1 and 2	3,851	2,296	217	9.45	175	7.62	99	4.31	28	1.26	519	22.60

Table 2. Displacement from tag-release site to tag-recovery site of blue king crabs tagged as legal males in 1995 and recovered during the 1995 St. Matthew Island commercial fishery summarized by survey strata. *“Total” is the average linear distance from release site to recovery site, “North” is the average linear distance north from release site to recovery site, “West” is the average linear distance west from release site to recovery site, and “Depth” is the average difference between recovery depth and release depth (positive values indicate recovery depth greater than release depth). Sample sizes are in parentheses.*

Stratum	Displacement			
	Total	North	West	Depth
1	35 km (13)	4 km (13)	-12 km (13)	-7 m (13)
2	18 km (101)	-12 km (101)	3 km (101)	9 m (110)
1 and 2	20 km (114)	-10 km (114)	1 km (114)	7 m (123)

Table 3. Male blue king crab tagging effort during the 1998 Alaska Department of Fish and Game St. Matthew Island blue king crab pot survey and 1998 commercial fishery recoveries.

Tagging Class	Stratum	Survey Catch	Number Tagged	1998 Commercial Fishery Recoveries	
				Number	Percent
Legal Males	1	2,563	2,527	255	10.09
	2	1,226	1,122	307	27.36
	1 and 2	3,789	3,649	562	15.40
Sublegal Males	1	1,699	1,500	82	5.47
	2	934	501	50	9.98
	1 and 2	2,633	2,001	132	6.60
All Males	1 and 2	6,422	5,650	694	12.28

Table 4. Displacement from tag-release site to tag-recovery site of blue king crabs tagged as legal males in 1998 and recovered during the 1998 St. Matthew Island commercial fishery summarized by survey strata. *“Total” is the average linear distance from release site to recovery site, “North” is the average linear distance north from release site to recovery site, “West” is the average linear distance west from release site to recovery site, and “Depth” is the average difference between recovery depth and release depth (positive values indicate recovery depth greater than release depth). Sample sizes are in parentheses.*

Stratum	Displacement			
	Total	North	West	Depth
1	24 km (197)	8 km (197)	-4 km (197)	-7 m (208)
2	20 km (235)	-8 km (235)	10 km (235)	8 m (240)
1 and 2	21 km (432)	-1 km (432)	4 km (432)	1 m (448)

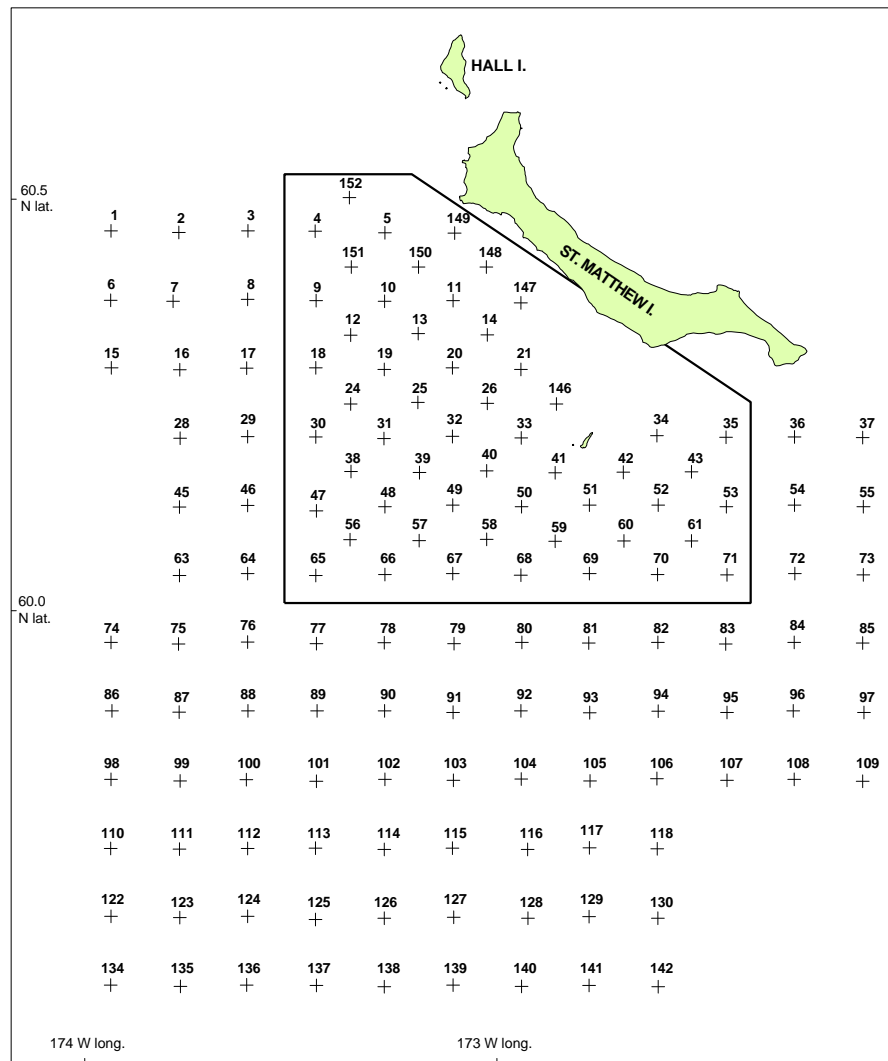


Figure 1. Station locations (mid-point) and strata sampled during the August 1995 St. Matthew Island blue king crab survey. *Stratum 2* stations are within the polygon; *Stratum 1* stations are outside the polygon.

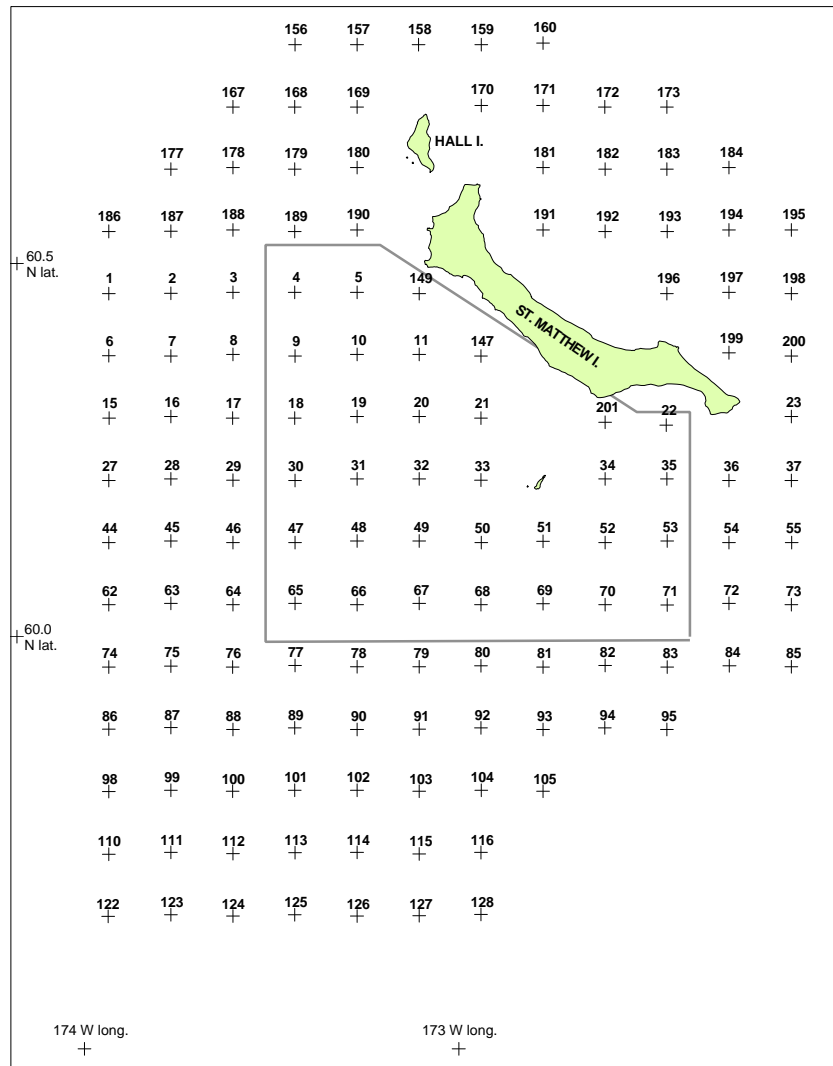


Figure 2. Station locations (mid-point) sampled during the August 1998 St. Matthew Island blue king crab survey. *Polygon indicates stations sampled that fall within the Stratum 2 stations sampled during the 1995 survey.*

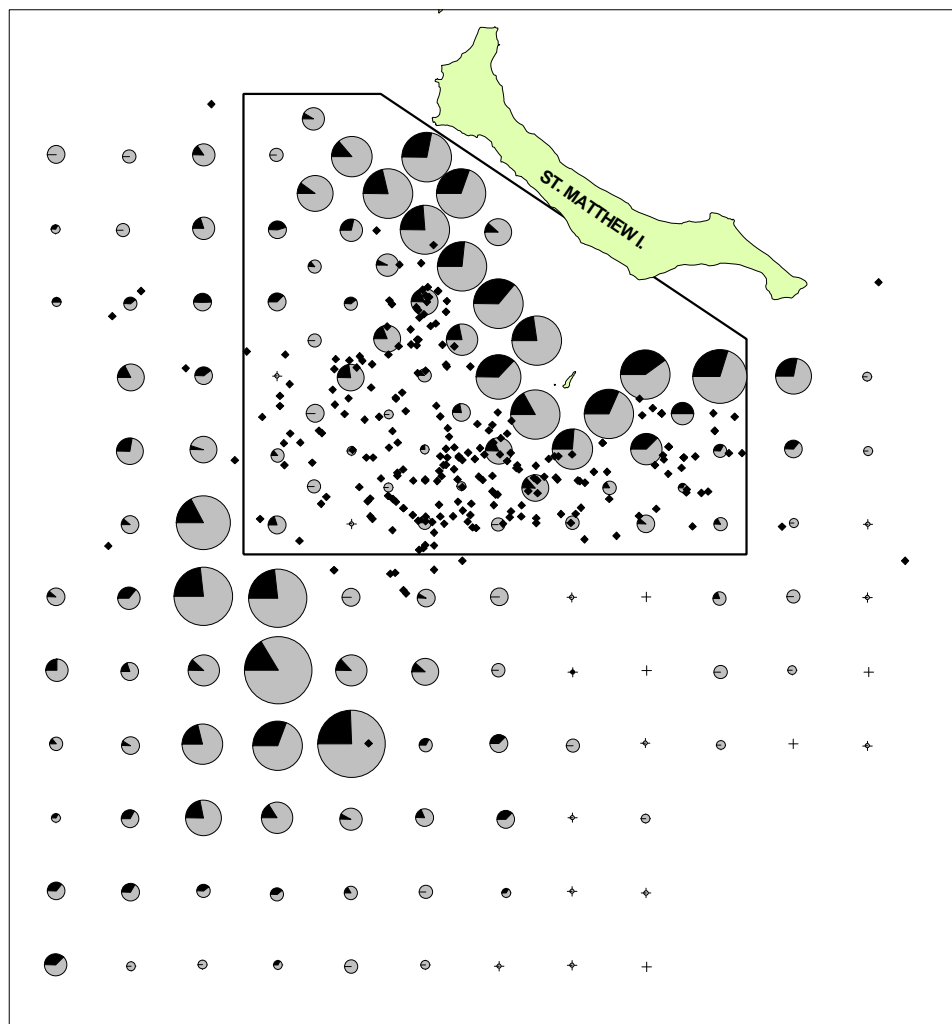


Figure 3. Distribution of tag releases of legal male blue king crabs during the August 1995 St. Matthew Island blue king crab survey, with recovery rate by station of release and recorded recovery locations during the 1995-1998 St. Matthew Island commercial fisheries. *Circles are proportional in size to the number of tagged crabs released per station; the largest circle represents 102 crabs. Area of black in each circle is proportional to the number of tagged crabs recovered during the 1995-1998 commercial fisheries. Black diamonds represent the 247 reported recovery locations during the 1995 - 1998 fisheries.*

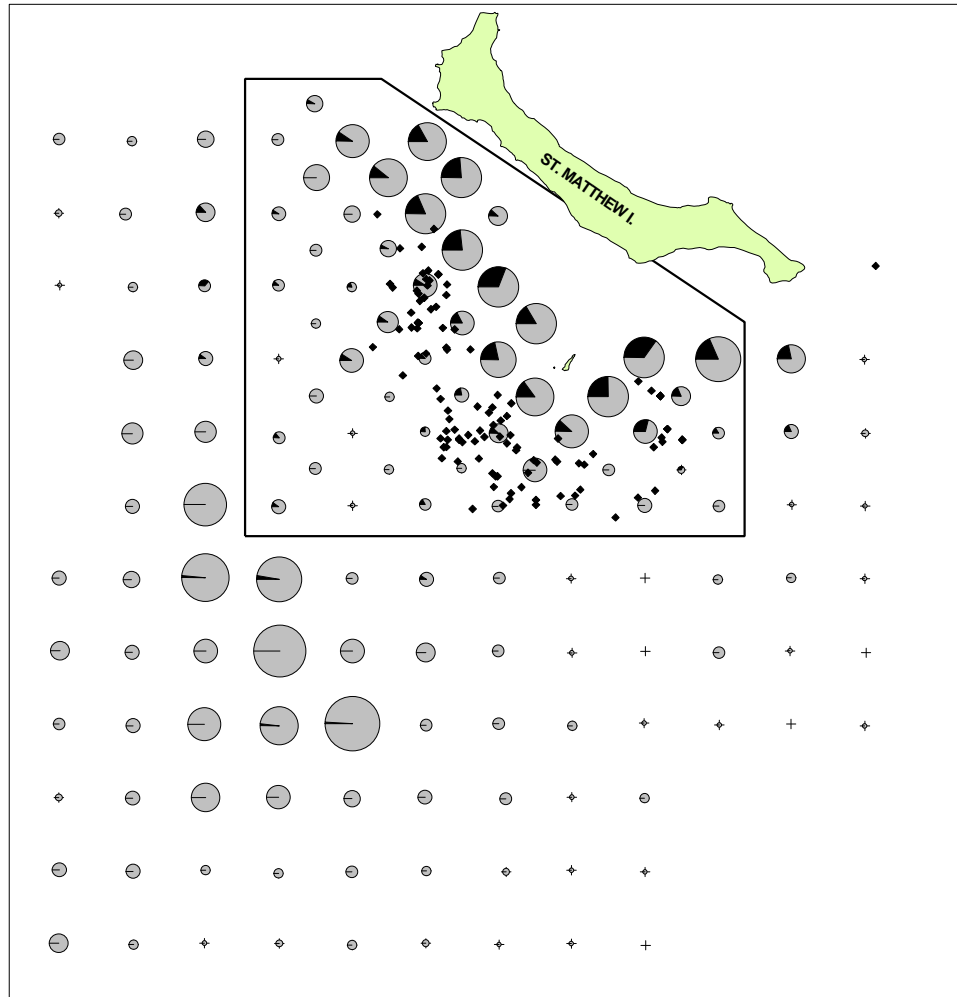


Figure 4. Distribution of tag releases of legal male blue king crabs during the August 1995 St. Matthew Island blue king crab survey, with recovery rate by station of release and recorded recovery locations during the 1995 St. Matthew Island commercial fishery. *Circles are proportional in size to the number of tagged crabs released per station; the largest circle represents 102 crabs. Area of black in each circle is proportional to the number of tagged crabs recovered during the 1995 commercial fishery. Black diamonds represent the 114 reported recovery locations during the 1995 fishery.*

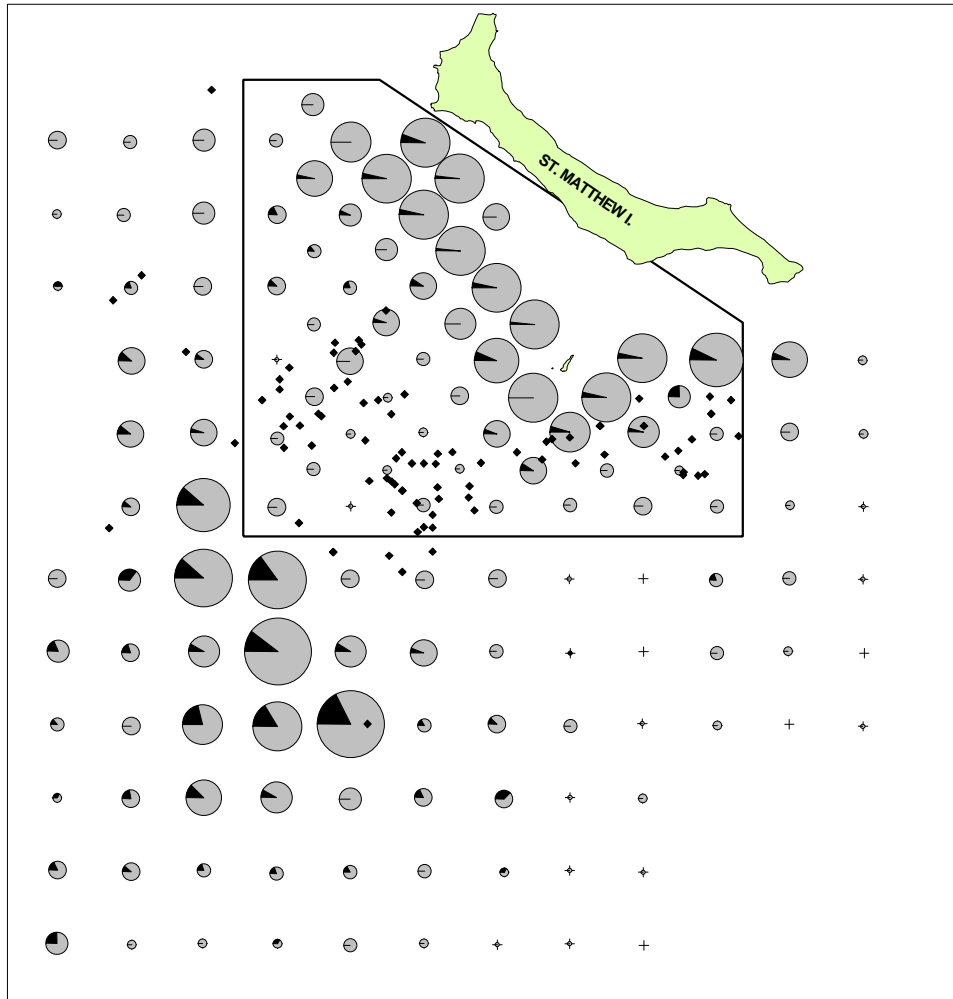


Figure 5. Distribution of tag releases of legal male blue king crabs during the August 1995 St. Matthew Island blue king crab survey, with recovery rate by station of release and recorded recovery locations during the 1996 St. Matthew Island commercial fishery. *Circles are proportional in size to the number of tagged crabs released per station; the largest circle represents 102 crabs. Area of black in each circle is proportional to the number of tagged crabs recovered during the 1996 commercial fishery. Black diamonds represent the 86 reported recovery locations during the 1996 fishery.*

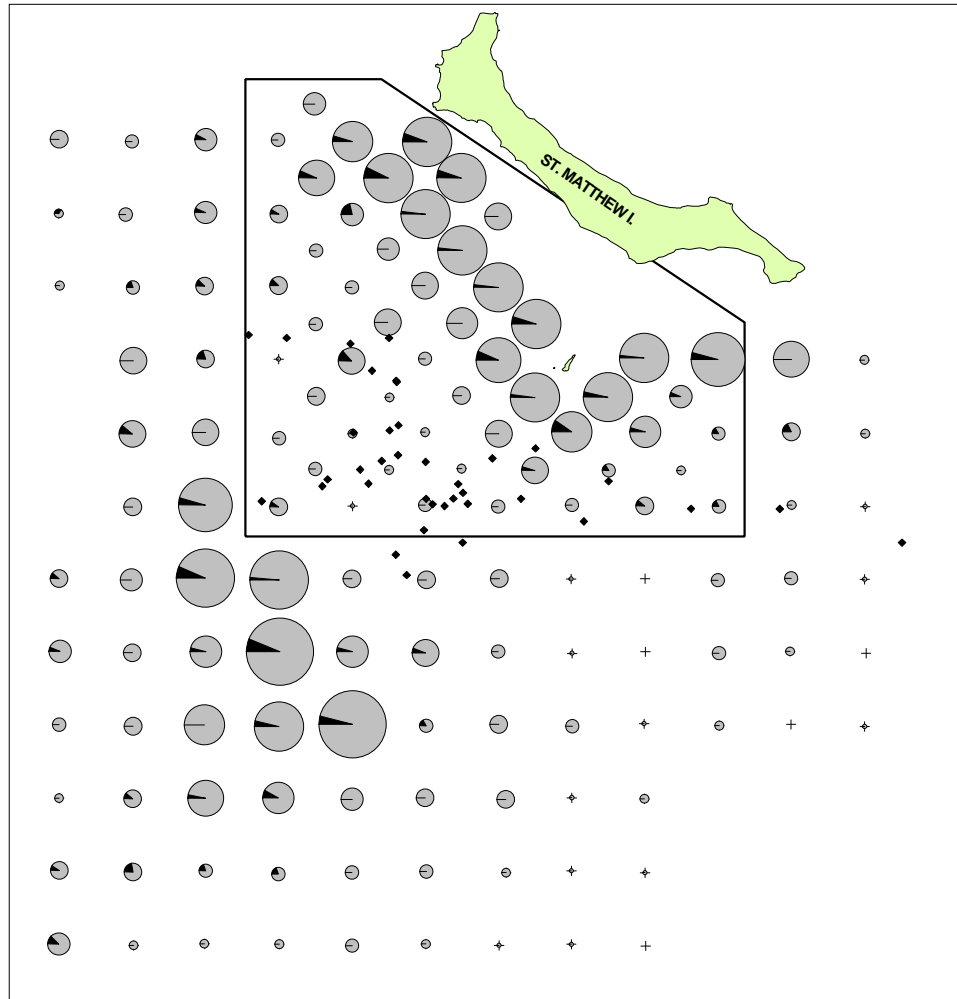


Figure 6. Distribution of tag releases of legal male blue king crabs during the August 1995 St. Matthew Island blue king crab survey, with recovery rate by station of release and recorded recovery locations during the 1997 St. Matthew Island commercial fishery. *Circles are proportional in size to the number of tagged crabs released per station; the largest circle represents 102 crabs. Area of black in each circle is proportional to the number of tagged crabs recovered during the 1997 commercial fishery. Black diamonds represent the 36 reported recovery locations during the 1997 fishery.*

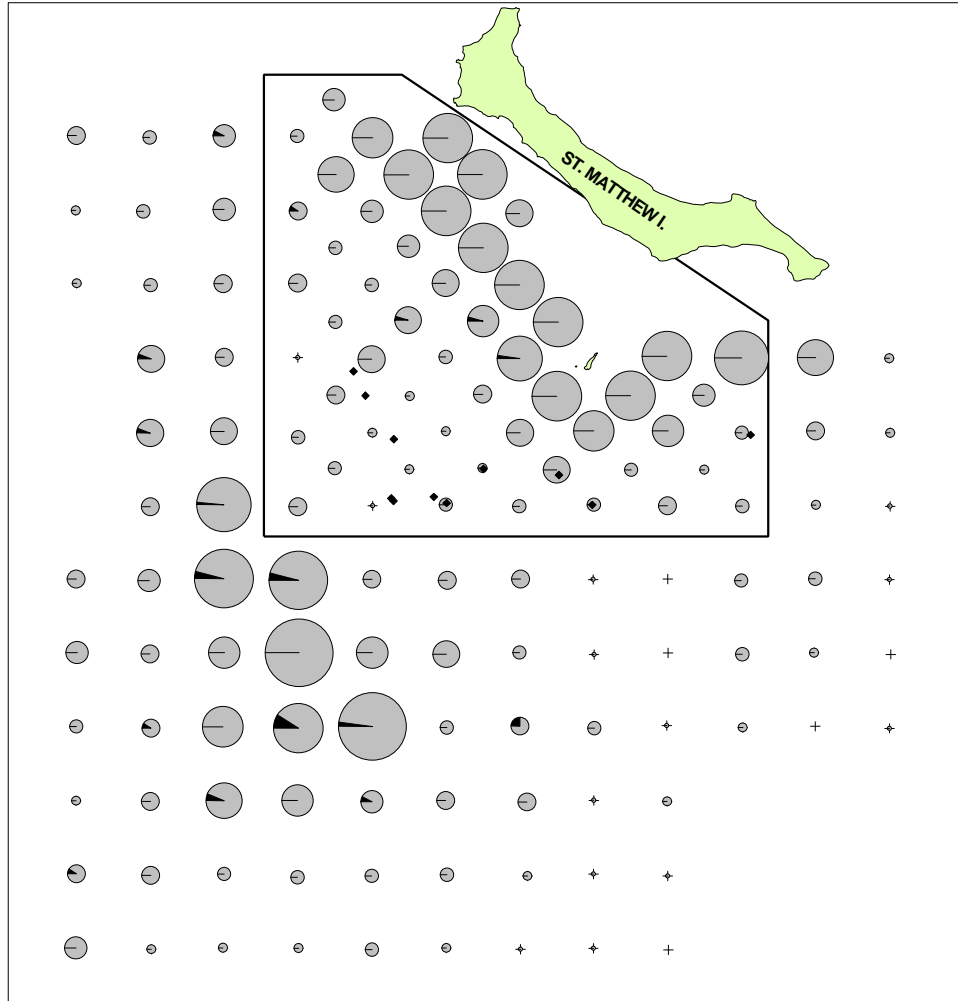


Figure 7. Distribution of tag releases of legal male blue king crabs during the August 1995 St. Matthew Island blue king crab survey, with recovery rate by station of release and recorded recovery locations during the 1998 St. Matthew Island commercial fishery. *Circles are proportional in size to the number of tagged crabs released per station; the largest circle represents 102 crabs. Area of black in each circle is proportional to the number of tagged crabs recovered during the 1998 commercial fishery. Black diamonds represent the 11 reported recovery locations during the 1998 fishery.*

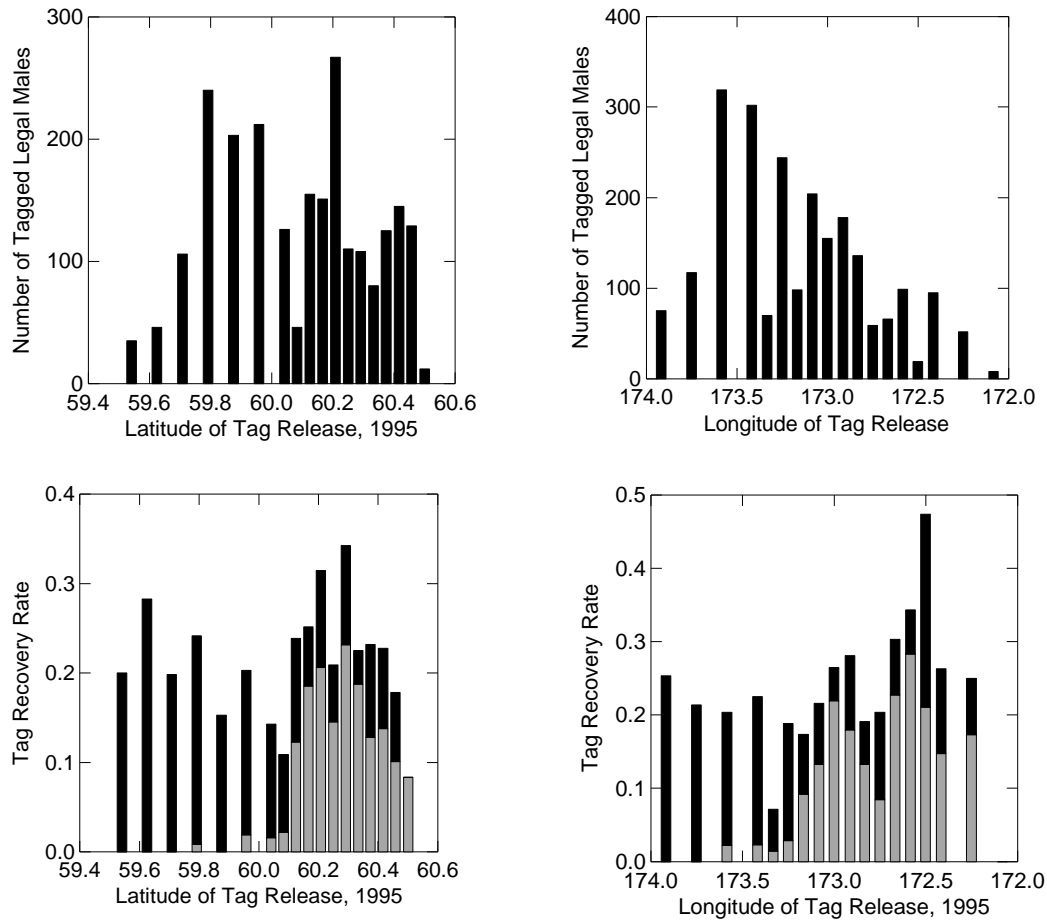


Figure 8. Number of legal male blue king crabs tagged and released by North latitude (top left panel) and West longitude (top right panel) in 1995 with recovery rate by North latitude (bottom left panel) and West longitude (bottom right panel) of release during the 1995 (gray bars) and the 1996-1998 (black bars) commercial St. Matthew Island fisheries.

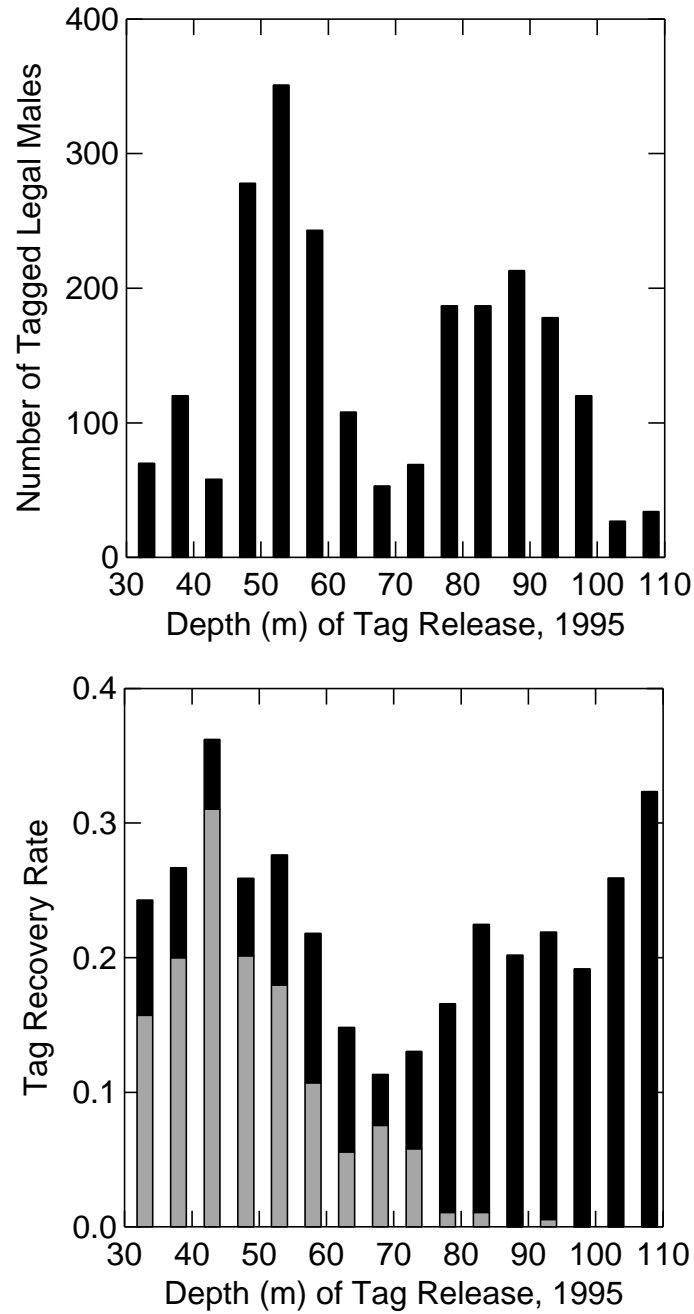


Figure 9. Number of legal male blue king crabs tagged and released by 5-m depth zone (top panel) in 1995 with recovery rate by depth of release (bottom panel) during the 1995 (gray bars) and the 1996-1998 (black bars) commercial St. Matthew Island fisheries.

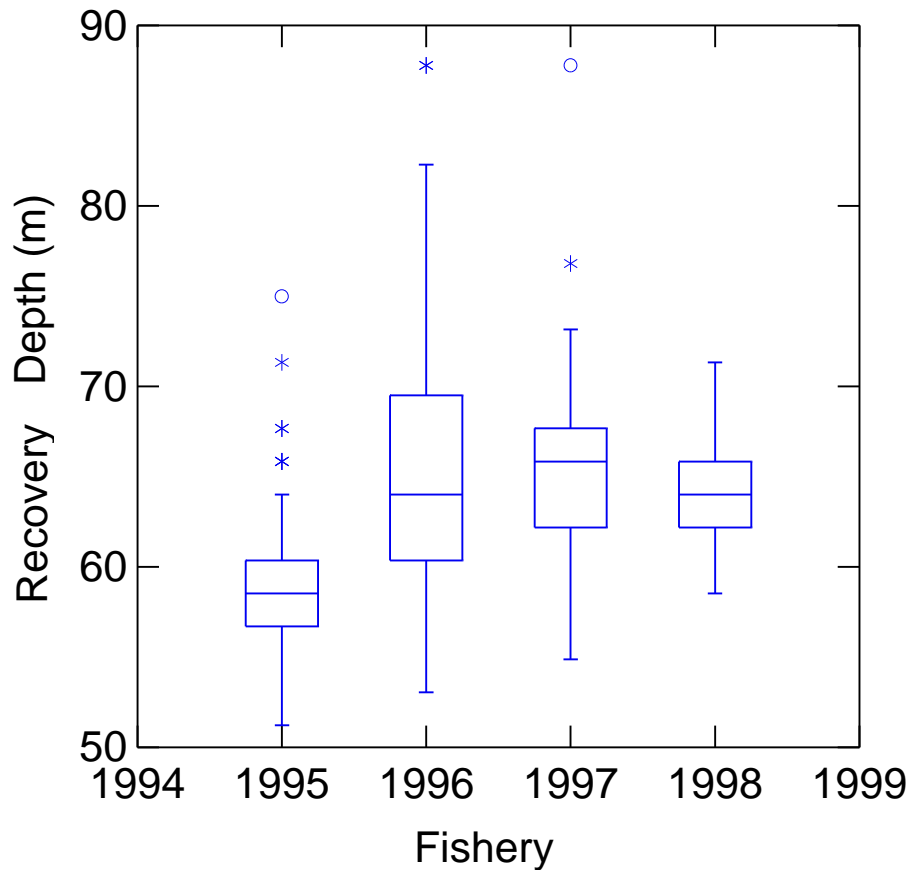


Figure 10. Box plots of depth (m) recorded at recovery for legal males tagged in 1995 that were recovered during the 1995 (N=123), 1996 (N=76), 1997 (N=70), and 1998 (N=15) commercial St. Matthew Island blue king crab fisheries.

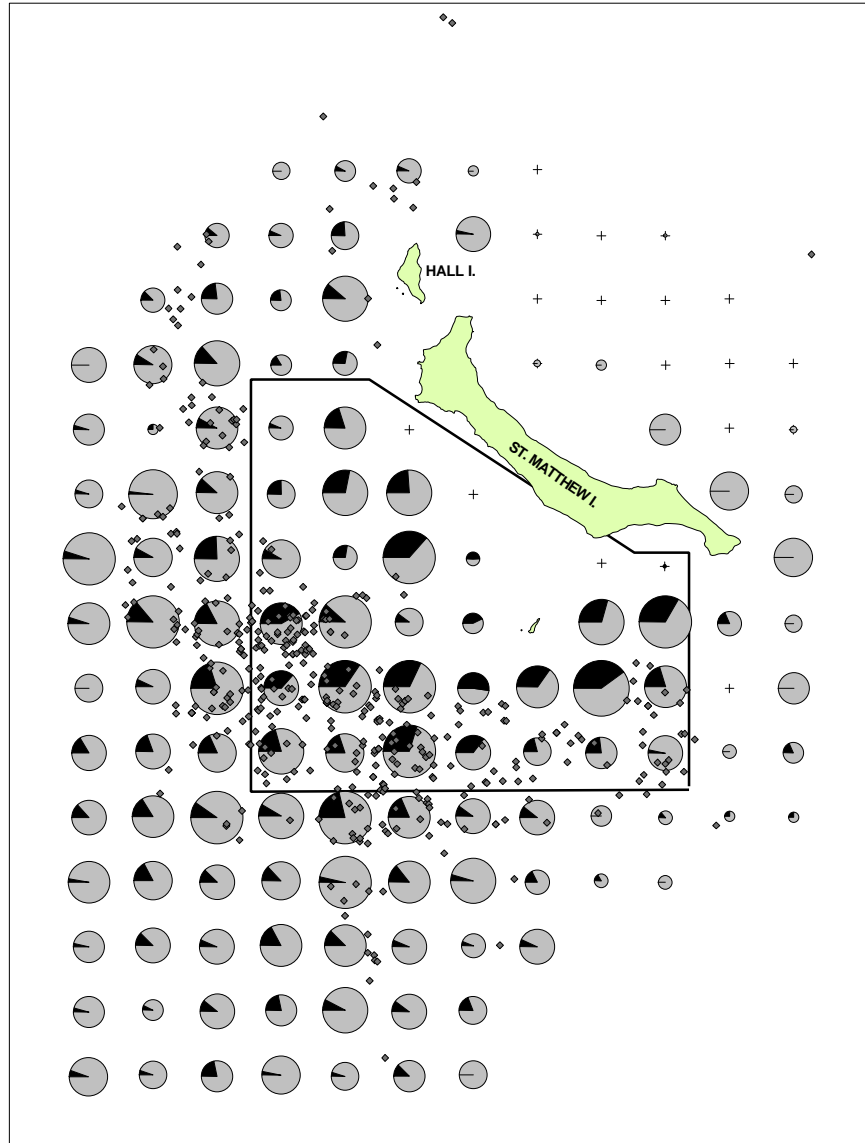


Figure 11. Distribution of tag releases of legal male blue king crabs during the August 1998 St. Matthew Island blue king crab survey, with recovery rate by station of release and recorded recovery locations during the 1998 St. Matthew Island commercial fishery. *Circles are proportional in size to the number of tagged crabs released per station; the largest circle represents 65 crabs. Area of black in each circle is proportional to the number of tagged crabs recovered during the 1998 commercial fishery. Black diamonds represent 432 reported recovery locations in the 1998 fishery.*

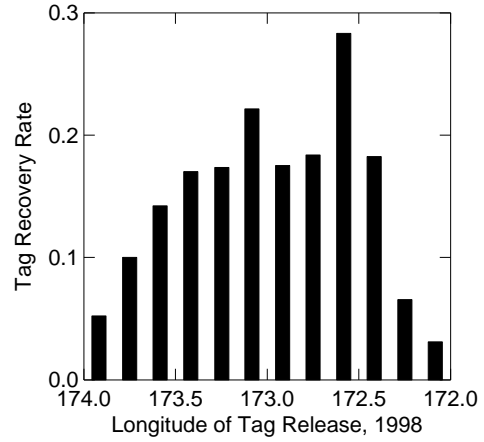
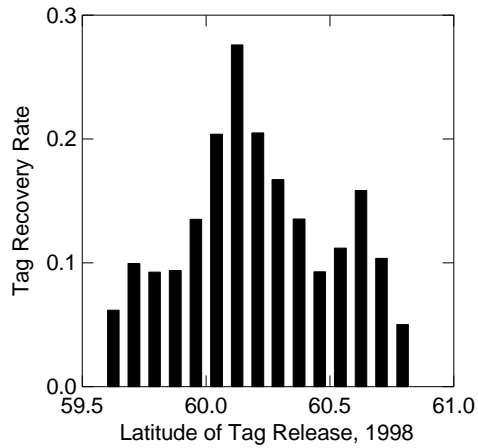
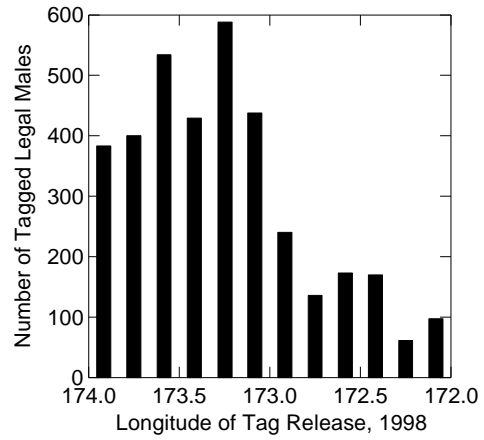
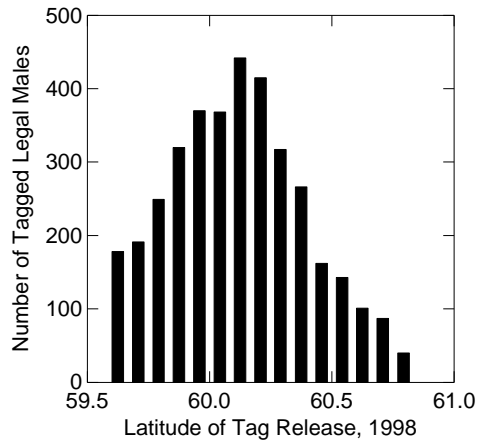


Figure 12. Number of legal male blue king crabs tagged and released by North latitude (top left panel) and West longitude (top right panel) in 1998 with recovery rate by North latitude (bottom left panel) and West longitude (bottom right panel) of release during the 1998 commercial St. Matthew Island fishery.

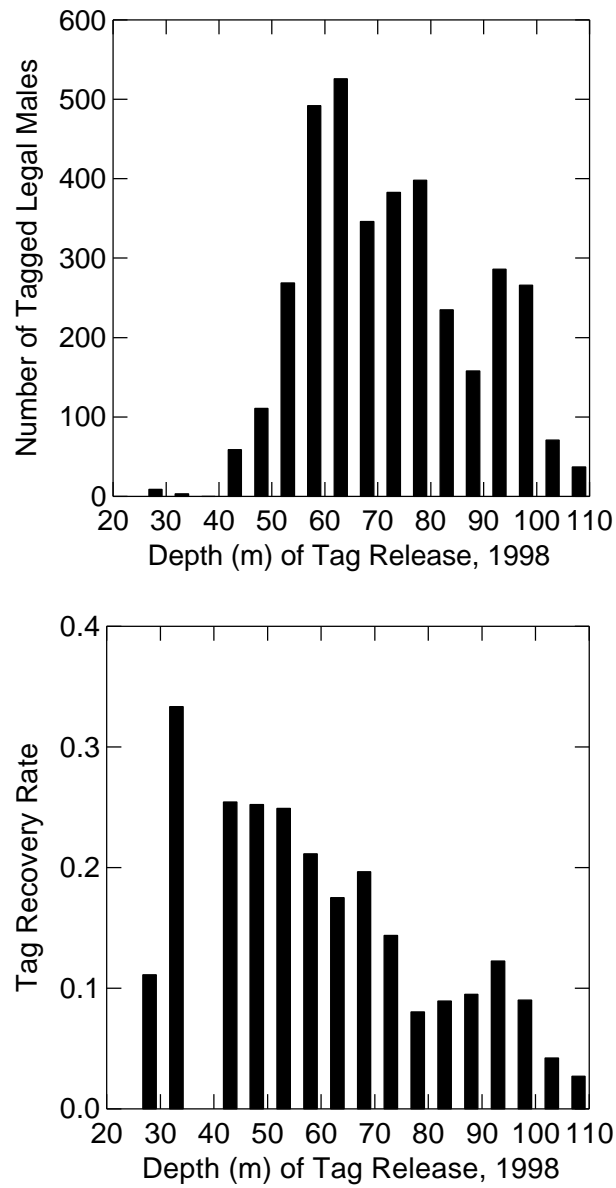


Figure 13. Number of legal male blue king crabs tagged and released by 5-m depth zone (top panel) in 1998 with recovery rate by depth of release (bottom panel) during the 1998 commercial St. Matthew Island fishery.

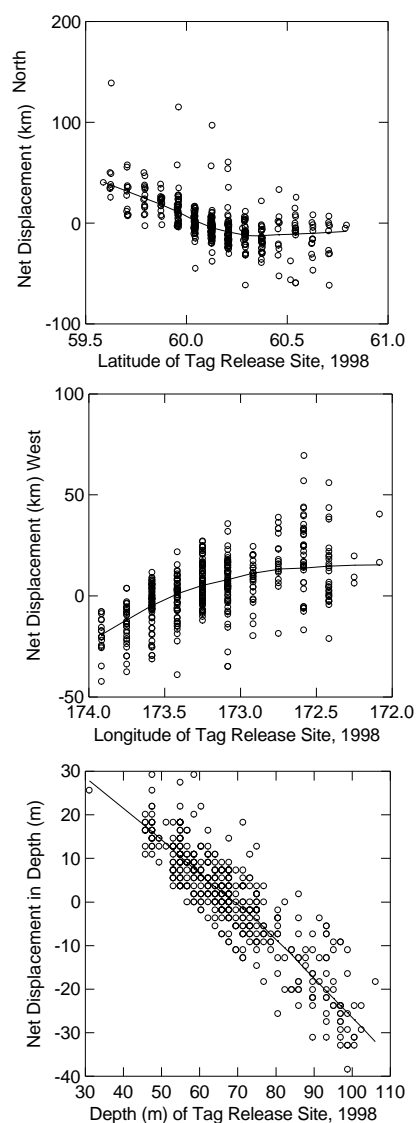


Figure 14. Displacement north from release to recovery site as a function of latitude of release site (top panel), displacement west from release site to recovery site as a function of longitude of release site (middle panel), and displacement in depth from release site to recovery site as a function of depth of release site for legal male blue king crab tagged in 1998 and recovered during the 1998 commercial St. Matthew Island fishery. *Curves in scatterplots are lowess smoothings of the data.*

APPENDIX

Appendix A.1. Legal male blue king crabs tagged in 1995 and recovered in the 1995-1998 St. Matthew Island commercial fisheries, by station and stratum.

STATION NUMBER	STRATUM	SURVEY CATCH	NUMBER TAGGED	COMMERCIAL FISHERY RECOVERIES				
				1995	1996	1997	1998	ALL FISHERIES
1	1	10	8	0	0	0	0	0
2	1	6	5	0	0	0	0	0
3	1	13	13	0	0	1	1	2
4	2	21	7	0	0	0	0	0
5	2	91	43	4	0	2	0	6
6	1	3	3	0	0	1	0	1
7	1	6	6	0	0	0	0	0
8	1	15	15	2	0	1	0	3
9	2	21	11	1	2	1	1	5
10	2	28	14	0	1	3	0	4
11	2	154	59	11	2	1	0	14
12	2	12	7	0	1	0	0	1
13	2	25	13	1	0	0	0	1
14	2	256	60	14	1	1	0	16
15	1	2	2	0	1	0	0	1
16	1	5	5	0	1	1	0	2
17	1	8	8	3	0	1	0	4
18	2	17	8	1	1	1	0	3
19	2	13	5	1	1	0	0	2
20	2	46	22	2	2	0	0	4
21	2	115	58	18	2	1	0	21
24	2	9	5	0	0	0	0	0
25	2	41	21	2	1	0	1	4
26	2	46	23	4	0	0	1	5
28	1	17	17	0	2	0	1	3
29	1	16	10	1	1	2	0	4
30	2	3	1	0	0	0	0	0
31	2	46	22	2	0	3	0	5
32	2	17	7	1	0	0	0	1
33	2	90	46	10	3	3	1	17
34	2	146	60	21	2	1	0	24
35	2	142	70	13	5	3	0	21
36	1	32	32	7	2	0	0	9
37	1	3	2	0	0	0	0	0
38	2	19	9	0	0	0	0	0
39	2	9	4	0	0	0	0	0
40	2	17	9	2	0	0	0	2
41	2	107	53	8	0	1	0	9
42	2	203	60	15	2	2	0	19
43	2	33	16	3	4	1	0	8
45	1	18	18	0	2	2	1	5

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Appendix A.1. (page 2 of 4)

STATION NUMBER	STRATUM	SURVEY CATCH	NUMBER TAGGED	COMMERCIAL FISHERY RECOVERIES				ALL FISHERIES
				1995	1996	1997	1998	
46	1	21	21	0	1	0	0	1
47	2	15	7	1	0	0	0	1
48	2	5	2	0	0	0	0	0
49	2	9	4	1	0	0	0	1
50	2	35	17	2	1	0	0	3
51	2	87	42	5	2	4	0	11
52	2	46	24	7	1	1	0	9
53	2	12	6	1	0	1	0	2
54	1	11	11	2	0	2	0	4
55	1	3	3	0	0	0	0	0
56	2	14	7	0	0	0	0	0
57	2	12	4	0	0	0	0	0
58	2	8	4	0	0	0	0	0
59	2	41	22	0	2	1	0	3
60	2	13	6	0	0	1	0	1
61	2	6	3	1	0	0	0	1
63	1	9	9	0	1	0	0	1
64	1	71	69	0	8	3	1	12
65	2	20	10	1	0	1	0	2
66	2	2	1	0	0	0	0	0
67	2	12	6	1	0	0	0	1
68	2	11	6	0	0	0	0	0
69	2	15	7	0	0	0	0	0
70	2	18	9	0	0	1	0	1
71	2	13	6	0	0	1	0	1
72	1	2	2	0	0	0	0	0
73	1	1	1	0	0	0	0	0
74	1	9	9	0	0	1	0	1
75	1	14	14	0	5	0	0	5
76	1	80	77	1	9	5	3	18
77	1	75	73	2	11	1	3	17
78	1	10	8	0	0	0	0	0
79	1	11	11	1	0	0	0	1
80	1	15	8	0	0	0	0	0
81	1	2	1	0	0	0	0	0
82	1	0	0	0	0	0	0	0
83	1	5	5	0	1	0	0	1
84	1	5	5	0	0	0	0	0
85	1	1	1	0	0	0	0	0
86	1	16	16	0	3	1	0	4
87	1	10	10	0	2	0	0	2
88	1	25	25	0	2	1	0	3
89	1	98	97	0	10	6	0	17

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Appendix A.1. (page 3 of 4)

STATION NUMBER	STRATUM	SURVEY CATCH	NUMBER TAGGED	COMMERCIAL FISHERY RECOVERIES				
				1995	1996	1997	1998	ALL FISHERIES
90	1	25	23	0	2	1	0	3
91	1	19	17	0	1	1	0	2
92	1	13	6	0	0	0	0	0
93	1	3	1	0	1	0	0	1
94	1	0	0	0	0	0	0	0
95	1	6	6	0	0	0	0	0
96	1	2	2	0	0	0	0	0
97	1	0	0	0	0	0	0	0
98	1	7	7	0	1	0	0	1
99	1	11	11	0	0	0	1	1
100	1	42	42	0	9	0	0	9
101	1	56	55	1	9	2	5	17
102	1	103	102	1	18	4	2	25
103	1	6	6	0	1	1	0	2
104	1	16	8	0	1	0	2	3
105	1	9	5	0	0	0	0	0
106	1	2	1	0	0	0	0	0
107	1	2	2	0	0	0	0	0
108	1	0	0	0	0	0	0	0
109	1	1	1	0	0	0	0	0
110	1	3	3	0	1	0	0	1
111	1	9	9	0	2	1	0	3
112	1	36	32	0	4	1	2	7
113	1	25	25	0	2	2	0	4
114	1	13	13	0	0	0	1	1
115	1	17	11	0	2	0	0	2
116	1	8	8	0	3	0	0	3
117	1	1	1	0	0	0	0	0
118	1	4	4	0	0	0	0	0
122	1	11	11	0	2	1	1	4
123	1	9	9	0	1	2	0	3
124	1	7	5	0	1	1	0	2
125	1	5	5	0	1	1	0	2
126	1	6	6	0	1	0	0	1
127	1	7	5	0	0	0	0	0
128	1	3	3	0	1	0	0	1
129	1	1	1	0	0	0	0	0
130	1	1	1	0	0	0	0	0
134	1	16	16	0	4	2	0	6
135	1	4	4	0	0	0	0	0
136	1	2	2	0	0	0	0	0
137	1	3	3	0	1	0	0	1
138	1	5	5	0	0	0	0	0

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Appendix A.1. (page 4 of 4)

STATION NUMBER	STRATUM	SURVEY CATCH	NUMBER TAGGED	COMMERCIAL FISHERY RECOVERIES				
				1995	1996	1997	1998	ALL FISHERIES
139	1	3	3	0	0	0	0	0
140	1	1	1	0	0	0	0	0
141	1	1	1	0	0	0	0	0
146	2	114	61	10	1	3	0	14
147	2	31	17	2	0	0	0	2
148	2	132	59	14	1	3	0	18
149	2	83	53	9	3	3	0	15
150	2	114	56	6	2	4	0	12
151	2	59	30	0	1	2	0	3
152	2	25	12	1	0	0	0	1
TOTAL		3851	2296	217	175	99	28	519

Appendix A.2. Mature female blue king crabs tagged in 1995 and recovered in the 1995-1998 St. Matthew Island commercial fisheries, by station and stratum.

STATION NUMBER	STRATUM	SURVEY CATCH	NUMBER TAGGED	COMMERCIAL FISHERY RECOVERIES				
				1995	1996	1997	1998	ALL FISHERIES
1	1	0	0	0	0	0	0	0
2	1	0	0	0	0	0	0	0
3	1	0	0	0	0	0	0	0
4	2	0	0	0	0	0	0	0
5	2	6	3	0	0	0	0	0
6	1	0	0	0	0	0	0	0
7	1	0	0	0	0	0	0	0
8	1	0	0	0	0	0	0	0
9	2	2	2	0	0	0	0	0
10	2	0	0	0	0	0	0	0
11	2	39	23	0	0	0	0	0
12	2	0	0	0	0	0	0	0
13	2	1	1	0	0	0	0	0
14	2	113	24	0	0	0	0	0
15	1	0	0	0	0	0	0	0
16	1	0	0	0	0	0	0	0
17	1	0	0	0	0	0	0	0
18	2	0	0	0	0	0	0	0
19	2	0	0	0	0	0	0	0
20	2	2	2	0	0	0	0	0
21	2	372	26	1	0	0	0	1
24	2	2	2	0	0	0	0	0
25	2	3	1	0	0	0	0	0
26	2	11	10	0	0	0	0	0
28	1	0	0	0	0	0	0	0
29	1	0	0	0	0	0	0	0
30	2	0	0	0	0	0	0	0
31	2	2	2	0	0	0	0	0
32	2	2	2	0	0	0	0	0
33	2	77	26	2	0	0	0	2
34	2	557	25	2	0	0	0	2
35	2	19	17	1	0	0	0	1
36	1	7	0	0	0	0	0	0
37	1	0	0	0	0	0	0	0
38	2	0	0	0	0	0	0	0
39	2	1	1	0	0	0	0	0
40	2	5	5	0	0	0	0	0
41	2	202	25	0	0	0	1	1
42	2	238	24	1	0	0	0	1
43	2	10	8	0	0	0	0	0
45	1	0	0	0	0	0	0	0

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Appendix A.2. (page 2 of 4)

STATION NUMBER	STRATUM	SURVEY CATCH	NUMBER TAGGED	COMMERCIAL FISHERY RECOVERIES				ALL FISHERIES
				1995	1996	1997	1998	
46	1	0	0	0	0	0	0	0
47	2	1	1	0	0	0	0	0
48	2	1	1	0	0	0	1	1
49	2	6	5	0	0	0	0	0
50	2	30	24	1	0	0	0	1
51	2	49	26	2	0	0	0	2
52	2	6	5	1	0	0	0	1
53	2	5	5	0	0	0	0	0
54	1	0	0	0	0	0	0	0
55	1	0	0	0	0	0	0	0
56	2	1	0	0	0	0	0	0
57	2	0	0	0	0	0	0	0
58	2	6	6	0	0	0	0	0
59	2	5	5	0	0	0	0	0
60	2	2	2	0	0	0	0	0
61	2	0	0	0	0	0	0	0
63	1	0	0	0	0	0	0	0
64	1	0	0	0	0	0	0	0
65	2	0	0	0	0	0	0	0
66	2	1	1	0	0	0	0	0
67	2	2	2	0	0	0	0	0
68	2	5	5	0	0	0	0	0
69	2	3	3	0	0	0	0	0
70	2	0	0	0	0	0	0	0
71	2	0	0	0	0	0	0	0
72	1	0	0	0	0	0	0	0
73	1	0	0	0	0	0	0	0
74	1	0	0	0	0	0	0	0
75	1	0	0	0	0	0	0	0
76	1	0	0	0	0	0	0	0
77	1	0	0	0	0	0	0	0
78	1	0	0	0	0	0	0	0
79	1	0	0	0	0	0	0	0
80	1	1	1	0	0	0	0	0
81	1	0	0	0	0	0	0	0
82	1	0	0	0	0	0	0	0
83	1	0	0	0	0	0	0	0
84	1	0	0	0	0	0	0	0
85	1	0	0	0	0	0	0	0
86	1	0	0	0	0	0	0	0
87	1	0	0	0	0	0	0	0
88	1	0	0	0	0	0	0	0
89	1	0	0	0	0	0	0	0

-Continued-

Appendix A.2. (page 3 of 4)

STATION NUMBER	STRATUM	SURVEY CATCH	NUMBER TAGGED	COMMERCIAL FISHERY RECOVERIES				ALL FISHERIES
				1995	1996	1997	1998	
90	1	0	0	0	0	0	0	0
91	1	0	0	0	0	0	0	0
92	1	0	0	0	0	0	0	0
93	1	0	0	0	0	0	0	0
94	1	0	0	0	0	0	0	0
95	1	1	0	0	0	0	0	0
96	1	0	0	0	0	0	0	0
97	1	0	0	0	0	0	0	0
98	1	0	0	0	0	0	0	0
99	1	0	0	0	0	0	0	0
100	1	0	0	0	0	0	0	0
101	1	0	0	0	0	0	0	0
102	1	0	0	0	0	0	0	0
103	1	1	0	0	0	0	0	0
104	1	0	0	0	0	0	0	0
105	1	0	0	0	0	0	0	0
106	1	0	0	0	0	0	0	0
107	1	0	0	0	0	0	0	0
108	1	0	0	0	0	0	0	0
109	1	0	0	0	0	0	0	0
110	1	0	0	0	0	0	0	0
111	1	0	0	0	0	0	0	0
112	1	0	0	0	0	0	0	0
113	1	0	0	0	0	0	0	0
114	1	0	0	0	0	0	0	0
115	1	0	0	0	0	0	0	0
116	1	0	0	0	0	0	0	0
117	1	0	0	0	0	0	0	0
118	1	0	0	0	0	0	0	0
122	1	0	0	0	0	0	0	0
123	1	0	0	0	0	0	0	0
124	1	0	0	0	0	0	0	0
125	1	0	0	0	0	0	0	0
126	1	0	0	0	0	0	0	0
127	1	0	0	0	0	0	0	0
128	1	0	0	0	0	0	0	0
129	1	0	0	0	0	0	0	0
130	1	0	0	0	0	0	0	0
134	1	0	0	0	0	0	0	0
135	1	0	0	0	0	0	0	0
136	1	0	0	0	0	0	0	0
137	1	0	0	0	0	0	0	0
138	1	0	0	0	0	0	0	0

-Continued-

Appendix A.2. (page 4 of 4)

STATION NUMBER	STRATUM	SURVEY CATCH	NUMBER TAGGED	COMMERCIAL FISHERY RECOVERIES				
				1995	1996	1997	1998	ALL FISHERIES
139	1	0	0	0	0	0	0	0
140	1	0	0	0	0	0	0	0
141	1	0	0	0	0	0	0	0
146	2	313	33	1	0	0	0	1
147	2	63	24	2	1	0	0	3
148	2	181	22	2	0	0	0	2
149	2	9	6	0	0	0	0	0
150	2	18	15	1	0	0	0	1
151	2	1	0	0	0	0	0	0
152	2	1	1	0	0	0	0	0
TOTAL		2383	422	17	1	0	2	20

Appendix A.3. Immature female blue king crabs tagged in 1995 and recovered in the 1995-1998
St. Matthew I. commercial fisheries, by station and stratum.

STATION NUMBER	STRATUM	SURVEY CATCH	NUMBER TAGGED	COMMERCIAL FISHERY RECOVERIES				ALL FISHERIES
				1995	1996	1997	1998	
1	1	0	0	0	0	0	0	0
2	1	0	0	0	0	0	0	0
3	1	0	0	0	0	0	0	0
4	2	1	0	0	0	0	0	0
5	2	11	0	0	0	0	0	0
6	1	0	0	0	0	0	0	0
7	1	0	0	0	0	0	0	0
8	1	0	0	0	0	0	0	0
9	2	2	1	0	0	0	0	0
10	2	8	0	0	0	0	0	0
11	2	69	2	0	0	0	0	0
12	2	2	0	0	0	0	0	0
13	2	2	0	0	0	0	0	0
14	2	41	1	0	0	0	0	0
15	1	0	0	0	0	0	0	0
16	1	0	0	0	0	0	0	0
17	1	0	0	0	0	0	0	0
18	2	0	0	0	0	0	0	0
19	2	5	0	0	0	0	0	0
20	2	2	1	0	0	0	0	0
21	2	47	0	0	0	0	0	0
24	2	2	0	0	0	0	0	0
25	2	8	0	0	0	0	0	0
26	2	3	0	0	0	0	0	0
28	1	0	0	0	0	0	0	0
29	1	0	0	0	0	0	0	0
30	2	0	0	0	0	0	0	0
31	2	6	0	0	0	0	0	0
32	2	5	0	0	0	0	0	0
33	2	27	1	0	0	0	0	0
34	2	33	0	0	0	0	0	0
35	2	7	3	1	0	0	0	1
36	1	6	0	0	0	0	0	0
37	1	0	0	0	0	0	0	0
38	2	1	0	0	0	0	0	0
39	2	1	0	0	0	0	0	0
40	2	1	0	0	0	0	0	0
41	2	22	0	0	0	0	0	0
42	2	29	0	0	0	0	0	0
43	2	1	0	0	0	0	0	0
45	1	0	0	0	0	0	0	0

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Appendix A.3. (page 2 of 4)

STATION NUMBER	STRATUM	SURVEY CATCH	NUMBER TAGGED	COMMERCIAL FISHERY RECOVERIES				ALL FISHERIES
				1995	1996	1997	1998	
46	1	0	0	0	0	0	0	0
47	2	0	0	0	0	0	0	0
48	2	0	0	0	0	0	0	0
49	2	3	0	0	0	0	0	0
50	2	6	0	0	0	0	0	0
51	2	6	0	0	0	0	0	0
52	2	1	0	0	0	0	0	0
53	2	2	1	0	0	0	0	0
54	1	2	0	0	0	0	0	0
55	1	5	0	0	0	0	0	0
56	2	0	0	0	0	0	0	0
57	2	2	0	0	0	0	0	0
58	2	1	0	0	0	0	0	0
59	2	1	0	0	0	0	0	0
60	2	0	0	0	0	0	0	0
61	2	1	0	0	0	0	0	0
63	1	0	0	0	0	0	0	0
64	1	0	0	0	0	0	0	0
65	2	0	0	0	0	0	0	0
66	2	0	0	0	0	0	0	0
67	2	0	0	0	0	0	0	0
68	2	0	0	0	0	0	0	0
69	2	1	0	0	0	0	0	0
70	2	3	0	0	0	0	0	0
71	2	3	0	0	0	0	0	0
72	1	1	0	0	0	0	0	0
73	1	0	0	0	0	0	0	0
74	1	0	0	0	0	0	0	0
75	1	0	0	0	0	0	0	0
76	1	0	0	0	0	0	0	0
77	1	0	0	0	0	0	0	0
78	1	0	0	0	0	0	0	0
79	1	0	0	0	0	0	0	0
80	1	0	0	0	0	0	0	0
81	1	0	0	0	0	0	0	0
82	1	0	0	0	0	0	0	0
83	1	0	0	0	0	0	0	0
84	1	0	0	0	0	0	0	0
85	1	1	0	0	0	0	0	0
86	1	0	0	0	0	0	0	0
87	1	0	0	0	0	0	0	0
88	1	0	0	0	0	0	0	0
89	1	1	0	0	0	0	0	0

-Continued-

Appendix A.3. (page 3 of 4)

STATION NUMBER	STRATUM	SURVEY CATCH	NUMBER TAGGED	COMMERCIAL FISHERY RECOVERIES				ALL FISHERIES
				1995	1996	1997	1998	
90	1	0	0	0	0	0	0	0
91	1	0	0	0	0	0	0	0
92	1	1	0	0	0	0	0	0
93	1	0	0	0	0	0	0	0
94	1	0	0	0	0	0	0	0
95	1	0	0	0	0	0	0	0
96	1	0	0	0	0	0	0	0
97	1	0	0	0	0	0	0	0
98	1	0	0	0	0	0	0	0
99	1	0	0	0	0	0	0	0
100	1	0	0	0	0	0	0	0
101	1	0	0	0	0	0	0	0
102	1	0	0	0	0	0	0	0
103	1	0	0	0	0	0	0	0
104	1	0	0	0	0	0	0	0
105	1	0	0	0	0	0	0	0
106	1	0	0	0	0	0	0	0
107	1	0	0	0	0	0	0	0
108	1	0	0	0	0	0	0	0
109	1	0	0	0	0	0	0	0
110	1	0	0	0	0	0	0	0
111	1	0	0	0	0	0	0	0
112	1	0	0	0	0	0	0	0
113	1	0	0	0	0	0	0	0
114	1	0	0	0	0	0	0	0
115	1	0	0	0	0	0	0	0
116	1	0	0	0	0	0	0	0
117	1	0	0	0	0	0	0	0
118	1	0	0	0	0	0	0	0
122	1	0	0	0	0	0	0	0
123	1	0	0	0	0	0	0	0
124	1	0	0	0	0	0	0	0
125	1	0	0	0	0	0	0	0
126	1	0	0	0	0	0	0	0
127	1	0	0	0	0	0	0	0
128	1	0	0	0	0	0	0	0
129	1	0	0	0	0	0	0	0
130	1	0	0	0	0	0	0	0
134	1	0	0	0	0	0	0	0
135	1	0	0	0	0	0	0	0
136	1	0	0	0	0	0	0	0
137	1	0	0	0	0	0	0	0
138	1	0	0	0	0	0	0	0

-Continued-

Appendix A.3. (page 4 of 4)

STATION NUMBER	STRATUM	SURVEY CATCH	NUMBER TAGGED	COMMERCIAL FISHERY RECOVERIES				ALL FISHERIES
				1995	1996	1997	1998	
139	1	0	0	0	0	0	0	0
140	1	0	0	0	0	0	0	0
141	1	0	0	0	0	0	0	0
146	2	53	0	0	0	0	0	0
147	2	5	1	0	0	0	0	0
148	2	151	1	0	0	0	0	0
149	2	5	1	0	0	0	0	0
150	2	38	2	0	0	0	0	0
151	2	2	0	0	0	0	0	0
152	2	5	0	0	0	0	0	0
TOTAL		642	15	1	0	0	0	1

Appendix B.1. Legal male blue king crabs tagged in 1998 and recovered in the 1998 St. Matthew Island commercial fishery, including the 1998 CDQ fishery, by station and stratum.

STATION NUMBER	STRATUM	SURVEY CATCH	NUMBER TAGGED	1998 COMMERCIAL FISHERY RECOVERIES
1	1	23	23	1
2	1	4	4	1
3	1	40	39	3
4	2	16	16	1
5	2	40	40	8
6	1	21	21	1
7	1	56	56	1
8	1	43	43	5
9	2	20	20	5
10 ^a	2	46	46	13
11	2	51	50	12
15	1	63	61	3
16	1	38	38	3
17	1	50	49	12
18	2	37	37	3
19	2	18	18	5
20	2	125	60	22
21	2	6	6	3
22	2	1	1	1
23	1	39	38	0
27	1	40	40	2
28	1	58	58	8
29	1	48	46	8
30	2	43	43	18
31	2	79	60	7
32	2	19	19	2
33	2	14	14	6
34	2	51	51	15
35	2	76	60	20
36	1	16	16	3
37	1	8	8	0
44	1	21	20	0
45	1	29	29	2
46	1	64	60	12
47	2	30	30	11
48	2	67	61	21
49	2	59	59	19
50	2	23	23	12

-Continued-

Appendix B.1. (page 2 of 4)

STATION NUMBER	STRATUM	SURVEY CATCH	NUMBER TAGGED	1998 COMMERCIAL FISHERY RECOVERIES
51	2	41	40	14
52	2	68	65	26
53	2	39	39	8
54	1	1	0	0
55	1	25	25	0
62	1	31	31	5
63	1	31	31	6
64	1	33	33	6
65	2	49	48	10
66	2	35	35	7
67	2	65	64	19
68	2	31	31	11
69	2	19	19	4
70	2	26	26	6
71	2	32	31	1
72	1	7	7	0
73	1	11	11	2
74	1	30	30	4
75	1	44	43	7
76	1	61	61	6
77	1	49	48	4
78	1	63	61	13
79	1	43	43	8
80	1	30	30	3
81	1	29	28	3
82	1	12	12	0
83	1	7	7	1
84	1	4	4	1
85	1	4	4	1
86	1	39	39	1
87	1	35	35	6
88	1	33	32	4
89	1	38	38	5
90	1	59	59	2
91	1	42	42	6
92	1	46	46	2
93	1	17	17	3
94	1	6	6	1
95	1	6	6	0
98	1	27	27	1

-Continued-

Appendix B.1. (page 3 of 4)

STATION NUMBER	STRATUM	SURVEY CATCH	NUMBER TAGGED	1998 COMMERCIAL FISHERY RECOVERIES
99	1	33	32	4
100	1	31	31	2
101	1	41	41	7
102	1	40	40	5
103	1	32	32	2
104	1	17	17	1
105	1	29	29	2
110	1	25	25	1
111	1	14	14	1
112	1	28	28	3
113	1	23	23	5
114	1	51	51	4
115	1	29	29	3
116	1	21	21	4
122	1	37	37	2
123	1	19	19	1
124	1	24	23	5
125	1	34	34	1
126	1	23	21	1
127	1	24	24	3
128	1	20	20	0
147	2	0	0	0
149	2	0	0	0
156	1	10	9	0
157	1	13	13	1
158	1	16	15	1
159	1	3	3	0
160	1	0	0	0
167	1	18	18	2
168	1	16	16	1
169	1	21	21	5
170	1	30	30	1
171	1	1	1	0
172	1	0	0	0
173	1	1	1	0
177	1	16	16	2
178	1	26	26	6
179	1	13	13	3
180	1	45	45	5
181	1	0	0	0

-Continued-

Appendix B.1. (page 4 of 4)

STATION NUMBER	STRATUM	SURVEY CATCH	NUMBER TAGGED	1998 COMMERCIAL FISHERY RECOVERIES
182	1	0	0	0
183	1	0	0	0
184	1	0	0	0
186	1	29	29	0
187	1	34	34	3
188	1	45	45	6
189	1	12	12	2
190	1	18	18	5
191	1	2	2	0
192	1	4	4	0
193	1	0	0	0
194	1	0	0	0
195	1	0	0	0
196	1	26	25	0
197	1	0	0	0
198	1	2	2	0
199	1	36	34	0
200	1	9	9	0
201	2	0	0	0
TOTAL		3791	3649	576

^a Station 10 was surveyed twice. First-survey pots were inadvertently pulled early on August 13 (13.5 hr soak); second-survey pots were pulled on August 14 (20.2 hr soak). Numbers reported here represent the totals from first and second surveys of the station.

Appendix B.2. Sublegal male blue king crabs tagged in 1998 and recovered in the 1998 St. Matthew I. commercial fishery, including the 1998 CDQ fishery, by station and stratum.

STATION NUMBER	STRATUM	SURVEY CATCH	NUMBER TAGGED	1998 COMMERCIAL FISHERY RECOVERIES
1	1	17	17	0
2	1	28	27	3
3	1	37	33	3
4	2	17	9	0
5	2	25	12	0
6	1	19	19	0
7	1	26	23	3
8	1	54	29	2
9	2	87	17	1
10 ^a	2	68	22	0
11	2	11	7	0
15	1	45	44	5
16	1	27	27	0
17	1	58	47	5
18	2	89	22	3
19	2	51	9	1
20	2	30	19	4
21	2	7	1	0
22	2	3	1	0
23	1	69	38	0
27	1	7	7	0
28	1	21	20	1
29	1	51	47	5
30	2	40	35	8
31	2	58	25	3
32	2	23	8	1
33	2	17	4	1
34	2	22	11	3
35	2	57	50	6
36	1	30	26	1
37	1	8	6	0
44	1	1	1	0
45	1	31	31	0
46	1	37	37	4
47	2	36	29	4
48	2	36	27	4
49	2	33	11	1
50	2	25	9	1

-Continued-

Appendix B.2. (page 2 of 4)

STATION NUMBER	STRATUM	SURVEY CATCH	NUMBER TAGGED	1998 COMMERCIAL FISHERY RECOVERIES
51	2	20	17	1
52	2	6	6	0
53	2	27	27	1
54	1	7	7	0
55	1	16	15	0
62	1	8	7	2
63	1	13	13	0
64	1	37	37	3
65	2	43	43	2
66	2	44	35	3
67	2	18	12	0
68	2	10	6	1
69	2	15	14	1
70	2	4	4	0
71	2	8	8	0
72	1	1	1	0
73	1	5	4	0
74	1	7	7	0
75	1	10	10	0
76	1	43	43	4
77	1	17	17	1
78	1	53	50	11
79	1	23	22	0
80	1	11	11	0
81	1	6	6	0
82	1	6	5	0
83	1	8	8	0
84	1	5	4	0
85	1	1	1	0
86	1	13	12	1
87	1	12	10	0
88	1	8	7	1
89	1	53	53	2
90	1	21	19	1
91	1	20	20	3
92	1	30	30	0
93	1	6	6	0
94	1	6	6	0
95	1	6	6	0
98	1	14	14	0

-Continued-

Appendix B.2. (page 3 of 4)

STATION NUMBER	STRATUM	SURVEY CATCH	NUMBER TAGGED	1998 COMMERCIAL FISHERY RECOVERIES
99	1	13	13	0
100	1	10	9	0
101	1	20	20	3
102	1	23	22	1
103	1	19	16	3
104	1	7	7	0
105	1	17	17	1
110	1	7	7	1
111	1	11	11	0
112	1	7	7	0
113	1	9	9	0
114	1	17	17	1
115	1	10	10	0
116	1	8	8	0
122	1	12	12	0
123	1	9	9	0
124	1	7	6	0
125	1	7	7	2
126	1	6	6	2
127	1	4	4	1
128	1	9	9	0
147	2	1	0	0
149	2	1	1	0
156	1	2	2	0
157	1	5	4	1
158	1	11	11	1
159	1	4	4	0
160	1	0	0	0
167	1	8	7	0
168	1	6	6	1
169	1	9	8	0
170	1	15	13	1
171	1	1	1	0
172	1	1	1	0
173	1	0	0	0
177	1	14	12	0
178	1	57	45	0
179	1	15	11	0
180	1	54	43	1
181	1	2	2	0

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Appendix B.2. (page 4 of 4)

STATION NUMBER	STRATUM	SURVEY CATCH	NUMBER TAGGED	1998 COMMERCIAL FISHERY RECOVERIES
182	1	4	4	0
183	1	1	1	0
184	1	0	0	0
186	1	9	9	0
187	1	25	20	0
188	1	38	35	1
189	1	15	8	0
190	1	10	9	0
191	1	2	2	0
192	1	4	4	0
193	1	2	1	0
194	1	0	0	0
195	1	0	0	0
196	1	47	33	0
197	1	2	1	0
198	1	0	0	0
199	1	65	41	0
200	1	8	6	0
201	2	2	0	0
TOTAL		2634	2001	132

^a Station 10 was surveyed twice. First-survey pots were inadvertently pulled early on August 13 (13.5 hr soak); second-survey pots were pulled on August 14 (20.2 hr soak). Numbers reported here represent the totals from first and second surveys of the station.

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